Enhancing service interactions with conversational agents

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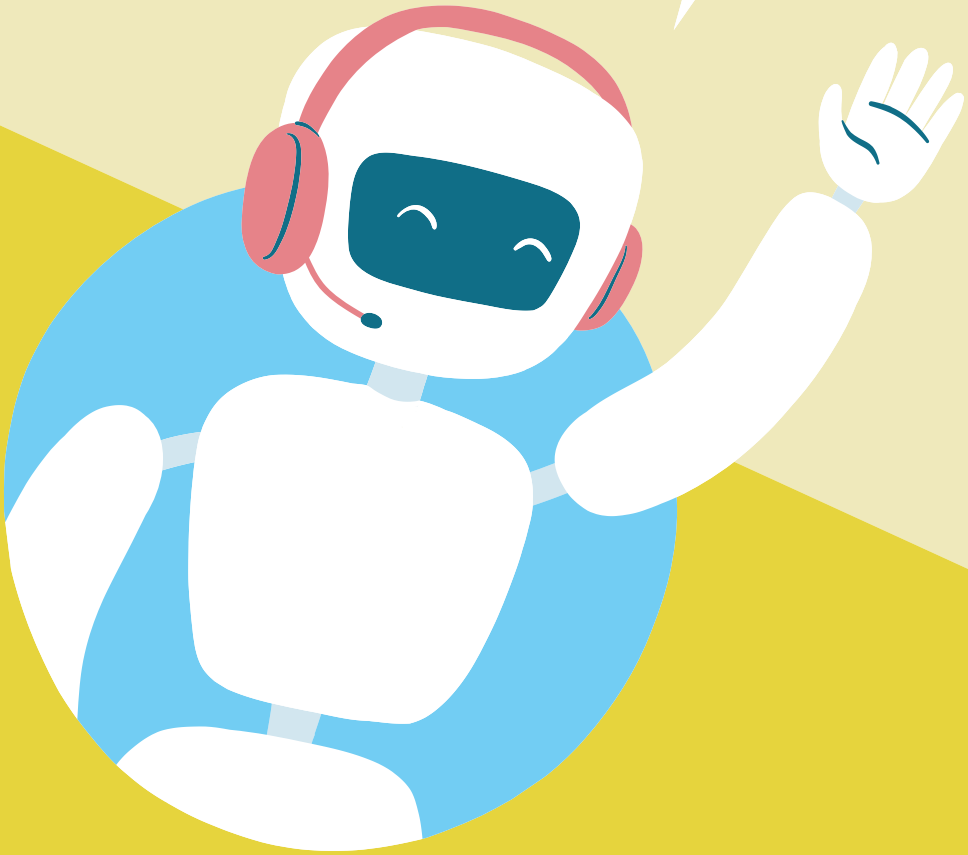
CHAPTER 1
INTRODUCTION

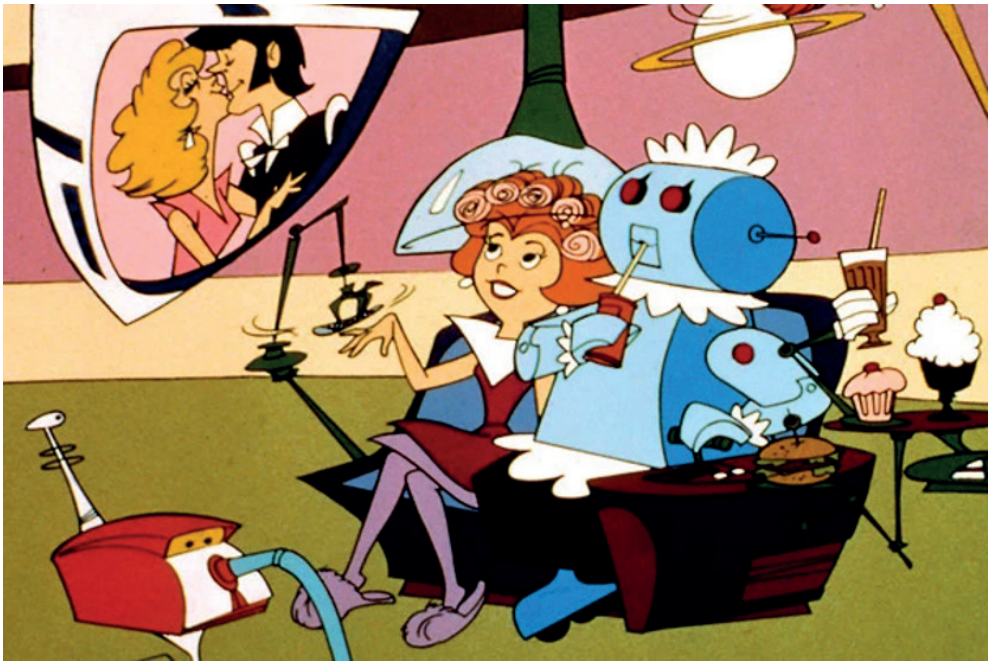


1.1 Motivation

As a kid growing up in the nineties, I vividly remember watching 'the Jetsons'; a comic animated series about an American middle-class family living in the year 2062. At the time, I had learned some English words from my older brothers, but could barely understand what was being said. Despite the language barrier, I remember being particularly fascinated by the family's robots, which strongly resembled humans in their appearance and behavior. The most iconic one and my personal favorite was 'Rosie', a quirky housekeeping robot. Although Rosie was outdated and did not deliver quality core service, she managed to win over the Jetson's hearts with her sense of humor and caring personality. Therefore, Rosie was perceived as a well-loved family member with *'a battery-powered heart of pure gold'* rather than a lifeless robot. As a viewer, I could not agree more and I secretly hoped that in the future I would have such a charming housekeeping robot cleaning up my house.

A plethora of recent blogs and mentions under the hashtag 'RosieTheRobot' show that I wasn't the only one with a fascination for Rosie. Rosie's popularity suggests that service providers looking to deploy conversational agents (chatbots, avatars, robots) in their services would do well to maximize the use of human-like communicative behaviors (HCBs). Rosie's HCBs triggered viewers like me to attribute human characteristics to her (e.g., warmth, friendliness, quirkiness), when we knew she could not have them. In the scientific literature, this phenomenon is termed anthropomorphism, which is defined as '*imbuing the imagined or real behavior of nonhuman agents with humanlike characteristics, motivations, intentions, and emotions'* (Epley et al., 2007, p.864). Anthropomorphism can also be beneficial for service providers, as the attribution of positive human characteristics has been found to enhance users' perceptions (e.g., warmth, competence) of the conversational agent (Holtgraves et al., 2007; Salem et al., 2013). These perceptions, in turn, drive indicators of relationship quality, such as liking, rapport, and trust (Hennig-Thurau, 2004; Palmatier et al., 2006). Consider, for example, a study by Salem et al. (2013) that has shown that service robots that gesture are liked more by users (a positive perception), who are consequently also more willing to interact with them again (a relationship quality indicator).

Figure 1 Rosie the housekeeping robot (right)



Yet, twenty years later, I have to admit that I find the idea of a quirky housekeeping robot, making witty comments and jokes perhaps a little creepy. We must not forget that, unlike cartoon characters, conversational agents are entities with whom users have to interact in a real-life service setting. In such a service setting, researchers have found that there is a limit to the positive effects of conversational agents' HCBs (S.Y. Kim et al., 2019; Mori et al., 2012). When exceeding this limit, users can experience an eerie sensation. In addition, researchers have shown that not all HCBs are equally effective when applied by conversational agents and that a one-size-fits-all approach does not work (Gray & Wegner, 2012; Um et al., 2020). Rather, various studies suggest that the positive effects of HCBs are dependent on users' individual needs and the service context. For example, Chattaraman et al. (2019) have found that the effects of communication style utilized by a service avatar are dependent on users' internet competency. Similarly, Keeling et al. (2010) have found that a social-oriented (cf. task-oriented) communication style used by a virtual service agent affects users' trust, however, most strongly for credence services (cf. search services)

However, as this research field is still in its infancy, it remains unclear which HCBs enhance users' perceptions of conversational agents and hence drive relational outcomes (Belanche et al., 2020; Chi et al., 2020; V.N. Lu et al., 2020). Furthermore, to successfully implement HCBs that enhance user's perceptions, two key findings are needed. First, for conversational agents to be useful in services, their communicative behaviors need to resonate with users' latent needs (Enninga et al., 2013). Yet, knowledge on the latent needs that users have regarding the HCBs used by conversational agents is absent. Second, although previous studies suggest the effects of HCBs are dependent on users' individual needs and the service context, it remains unclear how these factors should be taken into account (Chattaraman et al., 2019; Keeling et al., 2010). Therefore, this dissertation aims to answer the following overarching research question*: What are the effects of the use of HCBs by conversational agents on relational outcomes and how can these HCBs be implemented in service encounters considering users' individual needs and the service context?*

1.2 Context of the dissertation

This dissertation presents research on the effects of human-like communicative behaviors (HCBs) in conversational agents on relational outcomes in service settings. In order to outline the scope of this dissertation, the concepts HCBs, conversational agents, and relational outcomes will be discussed first. Furthermore, the process of anthropomorphism, through which HCBs are theorized to affect users' perceptions, will be elaborated upon. Lastly, research gaps and the structure of this dissertation will be presented.

1.2.1 Conversational agents: from Eliza to Alexa

In recent years, advances in technology have reshaped the nature of the service encounter at a profound rate (Huang & Rust, 2018). In particular, technology is increasingly used to substitute or augment human service employees (Larivière et al., 2017; Wirtz et al., 2018). The inclusion of technology enables service organizations to provide service to more users with fewer employees, thereby increasing their operational efficiency (Beatson et al., 2007). In turn, operational efficiency can result in lower costs and increased competitiveness. For users, benefits include increased service accessibility, service consistency, time and cost savings, and

greater perceived control over the service process (Curran & Meuter, 2005). As a result, the use of technology in service encounters has exponentially grown during the past two decades, and '*users can go further down the customer journey without human engagement than ever before*' (Gartner, 2015).

Figure 2 A typology of conversational agents

	Conversational agents		
	Chatbots	**Avatars**	**Robots**
Communicative behaviors	Verbal (written or spoken)	Verbal (written or spoken) Non-verbal	Verbal (written or spoken) Non-verbal
Embodiment	No embodiment or a picture	Virtual embodiment	Physical embodiment
Prominent examples	Personal assistants (Apple's SIRI), Customer service agents (IKEA's ANNA)	Educational agents (Duolingo, Dialoguetrainer)	Service robots (Pepper, Nao)

The deployment of conversational agents is one of the leading forms of technology inclusion in service encounters (Gartner, 2021). Conversational agents are '*systems that mimic human conversation*' using communication channels such as speech and text, but also facial expressions and gestures (Laranjo et al., 2018; Schuetzler et al., 2018). Conversational agents constitute various technologies, described in many different terms (e.g., embodied conversational agents, chatbots, dialog systems, virtual agents, bots). Following Radziwill and Benton (2017) and McTear et al. (2016), this dissertation focuses on three groups of conversational agents (CAs), which differ in their richness of communication: chatbots, avatars or virtual service agents (VSAs), and robots, see Figure 2. Chatbots are disembodied conversational agents that communicate primarily through written or spoken verbal communication (Araujo, 2018; Dale, 2016), although they can be accompanied by an image or a picture suggesting some form of embodiment. Avatars or virtual conversational agents are virtually embodied and can therefore also utilize nonverbal communicative behaviors, such as smiling and nodding (Cassell, 2000). Finally, robots are physically embodied, which allows them to also physically interact with users (Fink, 2012).

Despite the differences in their outward appearances, conversational agents all share the ability to mimic human communicative behavior and interact with the user through voice or text-based conversations (Dale, 2016).

Conversational agents have been around for a considerable number of years. In the 1960s, the first chatbots, 'the Rogerian psychotherapist ELIZA' (Weizenbaum, 1966) and 'the paranoid patient PARRY' (Colby, 1981), were built to demonstrate that it was possible to interact with computers through natural language. With the introduction of these agents, it became an objective to pass the so-called Turing test; a test named after the British mathematician Alan Turing, which is passed successfully if a conversational agent is mistaken for a human more than thirty percent of the time during a series of written interactions (Turing, 1950). Although it is disputable whether there are conversational agents that have actually passed the Turing test, the existence of the test has had a profound impact on their development. Contestants like A.L.I.C.E. (2001) and Smarterhild (2001) marked a starting point of major advances in Artificial Intelligence and, in particular, natural language processing (NLP). These technological advances have increased agents' capabilities to identify questions and keep interactions going (Radziwill & Benton, 2017). The technologies flourished further when companies such as APPLE (SIRI) and Amazon (Alexa) introduced voice assistants that were trained with large amounts of user data (Brill et al., 2019). These voice assistants paved the way for conversational agents in various service contexts. Consider, for example, conversational agents deployed as hotel receptionists (Tung & Au, 2018), financial advisors (Belanche et al., 2019), elderly caregivers (Čaić et al., 2018), and caterers (Garcia-Haro et al., 2021). Moreover, the application of conversational agents will continue to grow, as according to Gartner (2021), conversational agents are amongst the top four technologies that will bring most value to service organizations.

The rise of conversational agents can be explained by their expected benefits in human-less service encounters (Huang & Rust, 2021; Shum et al., 2017). Service encounters in which human services employees are substituted by technology (e.g., self-check in/out) are often experienced by users as impersonal and lacking human touch (Åkesson et al., 2014; Beatson et al., 2007; Giebelhausen et al., 2014). As conversational agents are able to mimic human communicative behaviors, they can strategically utilize the same myriad of HCBs (e.g., smiling, empathy) that are found to be important in human-to-human service encounters (van Doorn et al. 2017; Verhagen et al. 2014). Therefore, conversational agents are theorized enhance

users' perceptions (e.g., warmth, competence) (Holtgraves et al., 2007; Salem et al., 2013), which, in turn, drive indicators of relationship quality such as liking, rapport, and trust (Hennig-Thurau, 2004; Palmatier et al., 2006). In other words, conversational agents provide an opportunity for service providers to substitute or augment human service employees, without losing the human touch (Shum et al., 2018).

1.2.2 A theoretical perspective: conversational agents as social actors

In human-to-human service encounters, high-quality interaction between the service agent and the user is critical to the overall success of the service provider (Palmatier et al., 2006). Service encounters typically comprise some form of interaction during which the user infers perceptions of the service employee (e.g., competence, friendliness). These perceptions are profoundly influenced by the appearance, verbal and nonverbal communicative behaviors of the service employee (Nickson et al., 2005; Specht et al., 2007; Sundaram & Webster, 2000). For example, marketing research has shown that service employees who smile or show empathy are often evaluated more positively than employees who do not (Gremler & Gwinner, 2000). Positive perceptions of the service agent influence relational mediators, which are determinants of relationship quality and include trust, commitment, rapport, satisfaction, liking, (emotional) closeness, and interaction satisfaction, see Figure 3 (L. Anderson & Weitz, 1992; Gremler & Gwinner, 2000; Sirdeshmukh et al., 2002; Wulf et al., 2001). In turn, these relational mediators steer relational outcomes such as intention to use, word of mouth, loyalty, and cooperation (Hennig-Thurau, 2004; Palmatier et al., 2006).

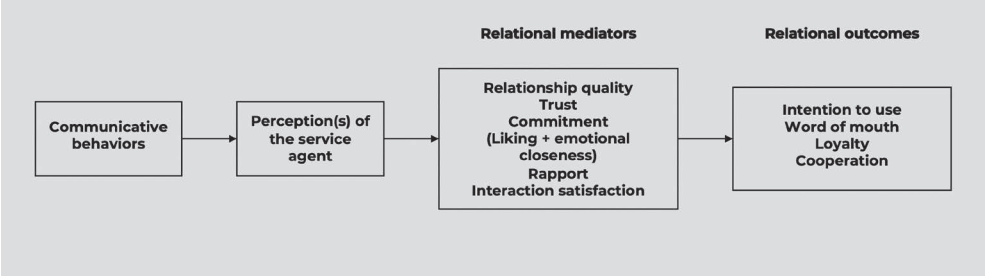
Evidence that the positive effects of the use of human communicative behaviors extend to conversational agents comes from the Computers As Social Actors (CASA) paradigm (Nass et al., 1994). Researchers within this paradigm have consistently demonstrated that humans unconsciously apply social rules and behaviors to computers, despite knowing that these computers are inanimate. For example, Nass et al. (1995) have shown that humans tend to infer perceptions of a computer's personality based on verbal (e.g., assertive vs. tentative language) and nonverbal behaviors (e.g., pitch, speech rate) of the computer. Furthermore, Moon (2000) has demonstrated that even subtle communicative behaviors, such as a computer disclosing technical details about itself, impact the user's tendency to

disclose intimate information in return. Therefore, the CASA paradigm suggests that the presence of HCBs in non-human agents induces the attribution of human-like perceptions to these agents.

In both services marketing and psychology, there is a growing consensus that this attribution of human-like perceptions to conversational agents can be further explained by anthropomorphism (Epley et al., 2007; Novak & Hoffman, 2019). Anthropomorphism entails that the presence of human-like characteristics or behaviors in non-human agents, unconsciously activates cognitive schemes for human-to-human interaction (Aggarwal & McGill, 2007; M.K. Lee et al., 2010). Due to this activation, humans tend to attribute human characteristics, motivations, intentions, or emotions to a non-human agent (Chaminade et al., 2010). By doing so, humans satisfy their need for social connection and their need to understand and control their environment (Epley et al., 2007; Waytz et al., 2010).

The human tendency to engage in anthropomorphism offers opportunities for service managers and designers who want to deploy conversational agents in their services. The attribution of human-like characteristics and traits to conversational agents increases the user's perceptions of the agent's (social) capabilities and hence relational mediators and outcomes (B.R. Duffy, 2003; Holtgraves et al., 2007). Therefore, the human-like perceptions induced by HCBs through anthropomorphism, facilitate interactions with conversational agents on a relational level (see Figure 3) and this entails that '*unlike other forms of technology, relationship-building with robots, especially service robots, is possible and even desired by users*' (Blut et al., 2021, p.637).

Figure 3 The role of communicative behaviors in service relationships



1.2.3 The current state-of-the-art: one-size does not fit all

Yet, current literature regarding the effectiveness of the use of HCBs by conversational agents on relational mediators and relational outcomes reveals mixed results (Blut et al., 2021; Feine et al., 2019; Hancock et al., 2011). Some scholars fail to find evidence for the positive effects of HCBs on relational mediators or relational outcomes (Ciechanowski et al., 2018; Goudey & Bonnin, 2016; S.Y. Kim et al., 2019), while others only find evidence for these effects in specific service contexts (Keeling et al., 2010), for specific combinations of HCBs (S. Choi et al., 2019), or for specific users (Chattaraman et al., 2019; Derrick & Ligon, 2014; Li & Mao, 2015). The use of HCBs by conversational agent is thus not a one-size-fits-all approach. However, to implement conversational agents in such way that that they do enhance relational outcomes, three knowledge gaps need to be addressed. The first gap concerns the fragmentation across the literature, which makes it difficult to draw conclusions regarding the effectiveness of the use of HCBs, while the second and third gap concern the conditions under which the use of HCBs yields positive effects.

First, the literature on conversational agents is scattered across disciplines (e.g., AI, psychology, marketing, computer science and communication science), and a clear overview of investigated behaviors and their effects is currently missing (Cowell and Stanney, 2005; van Doorn et al., 2017). Furthermore, the studies that research the effects of the use of HCBs investigate different relational mediators and outcomes in different service contexts, which further complicates obtaining such an overview. Yet, such an overview would allow researchers to pinpoint the HCBs that have yielded mixed effects and require further information. In addition, comparing such overview to the literature on service marketing would allow researchers to identify HCB's that are effective in human-to-human service interactions have not yet been investigated in conversational agents.

Second, we know that the effects of HCBs depend on the user's needs, the service context, and the phase in the interaction, but the relationship between the three has not been systematically mapped before (Chattaraman et al., 2019; Derrick & Ligon, 2014; Li & Mao, 2015). Studies that do investigate users' needs regarding the use of HCBs by conversational agents seem to focus on specific HCBs in isolation and do not take into account the service context or the phase in the service interaction (Komatsu & Kamide, 2017; Li & Mao, 2015; Payne et al., 2013).

This limitation is problematic, as it is precisely knowledge about how these factors interact that is needed to advance researchers' understanding on the effects of HCBs used by conversational agents. In addition, for conversational agents to be useful in services, their communicative behaviors need to resonate with users' latent needs (Enninga et al., 2013). Therefore, this knowledge will greatly benefit service providers and designers who want to integrate conversational agents in their services.

Third, HCBs can be implemented in different ways (e.g., in terms of frequency, timing or manifestation), but few studies compare multiple implementations of the same HCB. This gap is twofold. First, the literature suggest we should align the use of HCBs by conversational agents to users' needs (Chattaraman et al., 2019; Derrick & Ligon, 2014; Li & Mao, 2015), yet, users' needs change over time (Følstad & Kvale, 2018; Lemon & Verhoef, 2016). Therefore, it remains unclear whether HCBs of the conversational agents should adapt to those needs throughout the interaction or should remain constant. Second, anthropomorphism theory is ambiguous about which HCBs are anthropomorphized more readily and thus should be implemented in conversational agents (Epley et al., 2007). On the one hand anthropomorphism theory suggests that conversational agents are anthropomorphized more readily when they resemble humans in appearance, yet one the other hand anthropomorphism suggests that conversational agents are anthropomorphized more readily when they resemble humans in social functioning. This ambiguity in anthropomorphism theory raises interesting questions, as some users' needs can be taken into account by giving conversational agents certain external characteristics, but also by adding certain behaviors for social functioning. Answering these two implementation questions will help researchers in gaining a more comprehensive theoretical understanding on how anthropomorphism works and how its outcomes are affected by changing users' needs.

1.3 Contributions of the dissertation

To address these gaps in the literature, the main objective of this dissertation is to shed more light on users' latent needs for HCBs in conversational agents and investigate circumstances under which these HCBs successfully enhance relational outcomes. By doing so, this dissertation will answer the call for more research on the circumstances under which conversational agents can engage users on a

social and relational level (Larivière et al., 2017; van Doorn et al., 2017; Wirtz et al., 2018). To address these gaps, four chapters are presented that together will provide a more comprehensive overview of how HCBs should be used by conversational agents to successfully enhance relational outcomes. Figure 4 graphically depicts the aim of each study and how it addresses one of the three research gaps. The aim of chapter 2 is to establish a comprehensive overview of HCBs that have been investigated and their effects, with a particular focus on generating a taxonomy in which these HCBs can categorized. Chapter 3 aims to research which latent needs users have with regards to HCBs in conversational agents, taking into account possible differences between different phases of the service interaction and different service contexts. Finally, chapters 4 and 5 both aim to shed more light on how HCBs should be implemented to have a positive influence on relational mediators. More specifically, chapter 4 focuses on the timing and chapter 5 on the manifestation of the HCB. Section 1.4 describes these studies and their research questions in more detail, and Figure 5 provides a comprehensive overview of the dissertation.

Figure 4 Gaps addressed in each chapter

1.4 Dissertation overview

Chapter 2: Which HCBs used by conversational agents have been shown to have positive effects on relational mediators and outcomes and which additional behaviors from the human service marketing literature should be researched in the future?

The empirical literature on the effects of HCBs in conversational agents on relational mediators and outcomes is rapidly growing. However, this literature is highly scattered across disciplines and a systematic overview is missing (Cowell & Stanney, 2005; van Doorn et al., 2017). Although there are some reviews on HCBs in conversational agents, they do not map the effects of these HCBs on relational mediators or outcomes (Feine et al., 2019). A systematic review of the effects of HCBs on relational mediators and outcomes specifically, would allow researchers to identify mixed results and further investigate possible explanations for these results. In addition, it could inspire researchers to investigate additional behaviors from the human service marketing literature that have not been researched yet.

Therefore, chapter 2 presents a systematic literature review of 61 scientific articles from various disciplines that was conducted to identify which HCBs used by conversational agents have already been investigated and which effects they had on relational mediators and outcomes. Following grounded theory (Wolfswinkel et al., 2013), the independent variable(s) of each study were labeled using open and axial coding. This coding process resulted in a taxonomy with nine categories, divided over two dimensions. The first dimension ('modality') classifies the nature of the communicative behavior(s) in each study and distinguishes three categories: verbal behaviors, nonverbal behaviors, and appearance characteristics. The second dimension ('footing') describes the grounds on which communicative behaviors aim to establish relationships and distinguishes three categories; human similarity, individual similarity, and responsiveness. In a subsequent step, the results of the studies in each cell were analyzed in order to determine whether the cells contained predominantly unambiguous, mixed, or no results. Although the literature provides a clear understanding of the effects of the appearance of conversational agents, the effects of conversational agents' verbal and nonverbal behaviors remain unclear. In particular, the effects of these HCBs seem to be dependent on users' needs which can vary due to individual differences, the service context, and the phase of the service interaction. In addition, several behaviors that are effective in human-to-human interactions have not yet been investigated in conversational agents.

Chapter 3: How do needs for HCBs differ between users, service contexts and phases of the service interaction?

For conversational agents to be useful in services, their communicative behaviors need to resonate with users' latent needs (Enninga et al., 2013). Although the literature review presented in chapter 2 highlights the effect that users' needs might have on the effects of HCBs used by conversational agents, studies that explicitly investigating these latent needs are largely absent. Furthermore, although various studies suggest that needs vary due to individual differences, the service context, and the phase of the service interaction, knowledge on how these factors interact in determining users' needs is scarce (Chattaraman et al., 2019; S. Choi et al.,2019; Derrick & Ligon, 2014; Li & Mao, 2015).

Therefore, chapter 3 presents a generative design study that is particularly suitable to uncover communicative needs (Lavender et al., 2020). Generative design studies leverage the creativity of participants, enabling them to become aware of and express their thoughts and feelings, even if these thoughts and feelings were previously tacit or latent (Sanders & Stappers, 2012). In this particular study, participants were actively involved in the design of a virtual service agent for a medical or financial context. In order to express their preferences, participants followed four phases; 1) sensitization to the topic, 2) design of the agent's appearance using a face generator, 3) design of the agent's verbal and nonverbal communication using storylines and gamecards, and 4) a survey measuring demographics of the participants. To distill the tacit and latent needs behind participants' design choices, they were interviewed regarding their choices and underlying motivations. This study identified four users' needs regarding the appearance of VSAs (warmth, competence, conformity to social norms, and identification) and five needs regarding the verbal and nonverbal behaviors (warmth, competence, validation, convenience, pleasant user experience). Furthermore, results show that users' needs for appearance characteristics are widely shared and therefore only need to be adapted in such way that the user can identify with the agent. On the other hand, users' needs for nonverbal and verbal behaviors were found to be strongly linked to the phase in the conversation, the service context and the idiosyncratic needs of individual users. Specifically, users desired more social-oriented verbal and nonverbal behaviors in the healthcare context, during the beginning and the end of the interaction and when they needed validation. Moreover, there were no participants who did not desire any form of social-oriented behavior or who desired them during every turn.

Chapter 4: Are conversational agents utilizing a social (task) communication style more effective in enhancing the user's perceived social connection and if so, should they implement this in a static or adaptive manner?

The generative design study presented in chapter 3 concludes that users' latent needs concerning the verbal and nonverbal behaviors of the conversational agent are situational and linked to the phase in the conversation, the service context or the idiosyncratic needs of individual users. This finding implies that conversational agents that adapt their communicative behaviors to the situational needs of the user are more effective than conversational agents that do not. Chapter 4 presents an experimental study in which participants interacted with a virtual travel agent ('Charlotte'), whose communication style was manipulated. Some studies suggests that the use of a social-oriented communication style (opposed by a task-oriented communication style) by a conversational agent can foster a social connection (engagement, rapport) with the user (Araujo, 2018; de Cicco et al., 2020; Liebrecht et al., 2021; Strait et al., 2014). Establishing a social connection with the user is desirable, as a strong social connection has been found to drive service encounter satisfaction and intention to use (Gremler & Gwinner, 2000; Macintosh, 2009). Yet, results remain inconclusive on how such a social communication style should be implemented to optimally cater to the user's needs; should this be done in a static manner throughout the entire interaction, or in an adaptive manner by mimicking the user (Chattaraman et al., 2019; Li & Mao, 2015)?

The virtual travel agent in this experiment was manipulated to respond using a static task-oriented, static social-oriented or adaptive social-oriented communication style. In the adaptive social-oriented condition, the virtual agent only used a social-oriented communication style if the user chose a social-oriented reply in the previous turn. First of all, it was hypothesized that users would experience significantly higher levels of engagement and rapport in the social-oriented conditions compared to the task-oriented condition. In addition, it was hypothesized that users would experience significant higher levels of engagement and rapport in the adaptive social condition compared to the static social-oriented condition. This expectation was based on literature from the field of psychology, which suggests that mimicking conversation partners is an effective way to show responsiveness to their needs (K.A. Duffy & Chartrand, 2015). The results showed that an adaptive social-oriented communication style was most effective in enhancing both perceived engagement and rapport. Yet, the increase in engagement was mainly influenced by the adaptation to the user (adaptive social communication

style), while the increase in rapport was mainly influenced by the presence of social-communicative cues (static social communication style).

Chapter 5: Anthropomorphism and users' needs. Which robot features (appearance vs social functioning) affect anthropomorphism most?

The second implementation issue that was raised by the generative design study is that users differ in the value they place on the appearance of the conversational agent and the verbal and nonverbal behaviors used by the agent. Particularly, some participants indicated that they perceived the conversational agent as human if it resembles humans in appearance, while others indicated to have this perception when the agent resembled humans in social functioning. Therefore, human-like features that resemble humans in appearance and social functioning seem to affect anthropomorphism differently. Yet, anthropomorphism theory, which describes three user motivations for engaging in anthropomorphism, is ambiguous about which of these is more effective (Epley et al., 2007). The elicited agent knowledge motivation for anthropomorphism stipulates conversational agents should primarily look human, while the sociality motivation stipulates conversational agents should primarily function as a social human. In chapter 3, users indicated a strong need for social cues (validation) when they felt uncomfortable. This finding suggests that the effectiveness of different types of HCBs is dependent on the situational needs of individual users. However, previous literature on anthropomorphism has not investigated this relationship.

Chapter 5 addresses this gap by describing an experimental field study with a humanoid service robot. The service robot displayed gaze cues in the form of changing eye color in one condition and static eye color in the other. Thus, the robot was more human-like in its social functioning in one condition (displaying gaze cues, but not in the way that humans do) and more human-like in its appearance in the other (static eye color, but no gaze cues). It was hypothesized that interaction comfort would moderate the effect of gaze cues in such way that when comfort was low, gaze cues would have a stronger effect on anthropomorphism. The results indeed showed that interaction comfort moderates the effect of gaze cues on anthropomorphism, insofar as gaze cues increase anthropomorphism when comfort is low and decrease anthropomorphism when comfort is high. Anthropomorphism, in turn, positively influenced trust, which is important as it drives intention to use the service again. Yet, the influence of trust on intention is fully mediated by perceived enjoyment.

Figure 5 Title, theoretical gap, research method and the investigated type(s) of conversational agents and service context per chapter

Chapter	Title	Research gap	Research question	Method	Conversational agent type(s)	Service context
2	**Human-like communication in conversational agents:** a literature review and research agenda	As the literature is fragmented, there is no clear overview of HCBs that have already been studied and their effects on relational outcomes	Which communicative behaviors used by conversational agents have positive effects on relational outcomes and which additional behaviors or variables could be investigated in future research?	Systematic literature review	Chatbot Virtual agent Robot	Various
3	**Designing virtual service agents:** a creative approach for uncovering users' communicative needs	The effects of HCBs depend on the users' needs, the service context and the phase in the interaction, but the relationship between the three has not been systematically mapped before	What are users' needs for appearance characteristics and human-like communicative behaviors in conversational agents and how do these needs differ between service contexts and phases of the service interaction?	Generative design approach	Virtual agent	Healthcare, Finance
4	**The effects of communication style on relational outcomes in interactions between customers and conversational agents**	HCBs can be implemented in different ways, but few studies compare multiple implementations of the same HCB	What is the influence of the social-oriented communication style used by a conversational agent on the user's perceived social connection and is this effect more pronounced when such a communication style is implemented statically or adaptively?	Experiment	Virtual agent	Travel
5	**Trust in humanoid robots:** implications for services marketing		What is the influence of HCB type (appearance vs social function) on anthropomorphism and is this effect moderated by perceived interaction comfort?	Experiment	Robot	Hospitality

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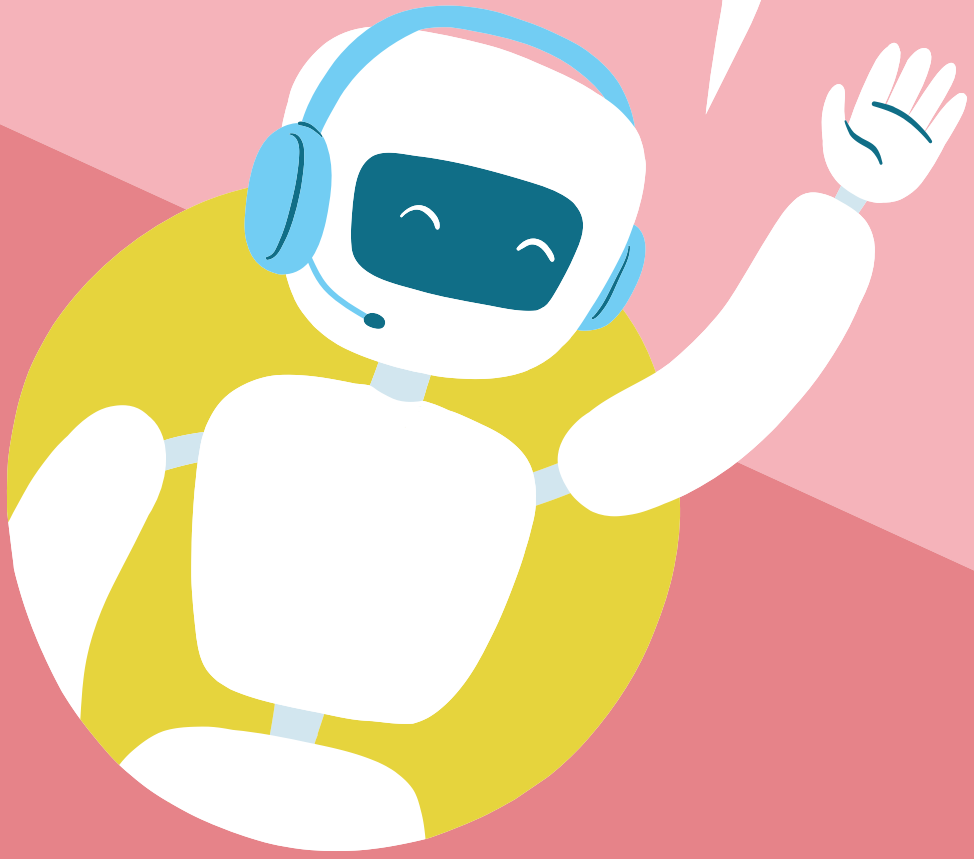
CHAPTER 2
HUMAN-LIKE COMMUNICATION IN CONVERSATIONAL AGENTS: A LITERATURE REVIEW AND RESEARCH AGENDA



2.1 Introduction

Today's service industry is gradually evolving to become technology-driven rather than human-driven. Due to developments in artificial intelligence (AI) and information and communication technology (ICT), technology is integrated into service encounters in many forms and shapes (Larivière et al., 2017; De Keyser et al., 2019; Wirtz et al., 2018). Consider, for example, self-service technologies such as self-checkout counters or mobile apps. Since these technologies encourage customers[1] to produce service outcomes independent of a human service employee (Meuter et al., 2005), they promise to bring benefits to both customers and service providers (Huang & Rust, 2021). But while developers are starting to overcome technological barriers, psychological barriers on the customer side become apparent (Åkesson et al., 2014; Lian, 2018). Customers need time to get acquainted with these new forms of service, which are often experienced as impersonal and lacking human touch (Dabholkar et al., 2003; Makarem et al., 2009).

To overcome these obstacles, conversational agents are increasingly deployed into service encounters (De Keyser et al., 2019; Ling et al., 2021). Conversational agents are '*systems that mimic human conversation*' using communication channels such as speech, text, but also facial expressions and gestures (Laranjo et al., 2018, p.1248; Radziwill & Benton, 2017). Conversational agents roughly consist of three categories: chatbots without embodiment, virtually embodied avatars, and physically embodied robots. The deployment of conversational agents in service encounters is growing exponentially in sectors such as hospitality, banking, entertainment, and healthcare, and also shows a gradual increase in other industries (Botanalytics, 2018; Lester et al., 2004). Examples include chatbots in schools teaching languages (Fryer & Carpenter, 2006), avatars recommending products in e-commerce (Qiu & Benbasat, 2010), and robots assisting elderly in healthcare (Čaić et al., 2018). Despite their technological progress and potential added value for social presence in automated service encounters, in reality, conversational agents hardly seem to foster relationships (Marinova et al., 2017). This lack of success may be due to the fact that conversational agents do not yet make optimal use of communicative behaviors that humans use to enhance relational outcomes. Indeed, several authors have suggested that to be utilized to their full potential, conversational agents should communicate more like humans (Fink, 2012; Wang et al., 2007).

[1] As this chapter specifically compares literature on conversational agents to literature on human service employees in commercial settings, the term 'customer' is used here instead of 'user'.

In recent years, many researchers have investigated how relational outcomes are affected by the implementation of human-like communicative behaviors (HCBs) (e.g., the use of body movements, humor or communication style) in conversational agents (Groom et al., 2009; Keeling et al., 2010; Niculescu & Banchs, 2018). However, this research is scattered across disciplines (e.g., artificial intelligence, psychology, marketing, computer science and communication science) and a clear overview of investigated behaviors and their effects is currently missing (Cowell & Stanney, 2005; van Doorn et al., 2017). This lack of overview is problematic, both for service managers who would like to optimize interactions between conversational agents and customers, and for academics who would like to do research in this area and identify promising avenues for future investigations.

Therefore, the current study will first create an overview of human-like communicative behaviors that have already been investigated in conversational agents and their effects. Secondly, a research agenda is constructed that points to potentially effective communicative behaviors that have not yet been explored, as well as remarkable findings in earlier studies that require further investigation. To this end, we first conduct a systematic literature review across different disciplines to identify which communicative behaviors have already been investigated in conversational agents with the goal of enhancing relational outcomes. Subsequently, we create a taxonomy of these behaviors using open and axial coding, so that in the next step, we can analyze which categories of behaviors have been investigated most frequently and how the effects on relational outcomes differ per category. For categories that are relatively under researched, we search the literature on human-to-human service encounters for potentially effective communicative behaviors that have thus far been overlooked in the literature on human-machine interaction. By following these steps, we aim to provide insight into which communicative behaviors used by conversational agents have positive effects on relational outcomes (Brandtzaeg & Følstad, 2017), and which additional behaviors or variables could be investigated in future research (Cassell, 2000).

2.2 Literature review

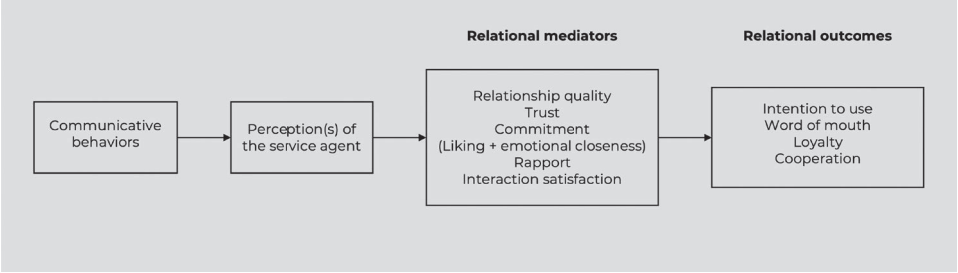
In this section, we will first explain how communicative behaviors affect relational mediators including trust, rapport, and liking in H2H service encounters. Subsequently, we will discuss why communicative behaviors are theorized to have similar effects in service encounters between humans and machines, such as conversational agents.

Finally, we will raise the issue that despite their ability to display communicative behaviors, conversational agents currently do not optimally establish relationships with customers, which provides the rationale for the current study.

2.2.1 Communicative behaviors in H2H service encounters

Numerous studies in the field of relationship marketing have recognized the importance of communication to the overall success of the service provider (Lin & Lin, 2017; Palmatier et al., 2006). Service encounters typically comprise some form of communication during which the customer infers a perception of the service employee (e.g., competence, friendliness) from verbal and nonverbal communicative behaviors that the employee displays, such as the use of gestures and expressions (Specht et al., 2007; Sundaram & Webster, 2000). These perceptions affect relational mediators such as trust and rapport, which in turn affect intention to use, word of mouth, loyalty, and cooperation, see Figure 2 (Hennig-Thurau et al., 2002; Palmatier et al., 2006). According to communication accommodation theory (Giles et al., 1991), efforts from the service employee to communicatively adapt to the customer's needs, contribute to a more positive perception of the service employee. Therefore, service employees strategically utilize communicative behaviors to actively steer customers' perceptions in the desired direction (Cronin & Taylor, 1994; Gremler & Gwinner, 2008). For example, service agents using the pronoun 'I' (first-person singular) instead of 'you' (second-person singular) or 'we' (first-person plural), are perceived as more empathetic (Packard et al., 2014). Perceived empathy, in turn, positively affects the quality of the relationship between the customer and the service provider, which is important as strong relationships drive intention to use the service again, word of mouth, loyalty, and cooperation (Crosby et al., 1990; Palmatier et al., 2006).

Figure 1 The role of communicative behaviors in service relationships



In both service management and marketing literature, relationship quality is theorized to mediate the relationship between customer perceptions and relational outcomes (Moliner, 2009; Palmatier et al., 2006). Relationship quality is an important multidimensional variable made up of key determinants that reflect the overall nature of an exchange relationship between customer and service provider (Hennig-Thurau et al., 2002). However, researchers disagree on which ones best capture the construct (see Vieira et al. (2008) for a comprehensive overview). For example, Morgan and Hunt (1994) propose that commitment (a combination of liking and emotional closeness), together with trust capture relationship quality the best, yet others suggest it is either trust (Sirdeshmukh et al., 2002) or commitment (E. Anderson & Weitz, 1992). Furthermore, some authors argue that a combination of commitment, trust, and relationship satisfaction (Wulf et al., 2001) or rapport (Gremler & Gwinner, 2000) provides a more suitable definition. The main focus of this study will be on communicative behaviors that improve the relationship quality between conversational agents and customers. Therefore, the operationalization of relationship quality in this study includes all these determinants, which from now on will be called relational mediators: 'trust', 'commitment', 'rapport', 'satisfaction', 'liking' and 'emotional closeness', see Figure 1.

2.2.2 Communicative behaviors in H2M service encounters

Implementing human-like communicative behaviors in conversational agents builds upon the 'Computers As Social Actors' or 'CASA' paradigm (Nass et al., 1994; Nass & Reeves, 1996). In a series of studies, several authors have demonstrated that humans tend to attribute essential human capacities and traits, such as personality, feelings or rational thought, to machines (e.g., Bickmore & Cassell, 2001). As a result, machines are treated as social interaction partners, able to engage in meaningful interaction. This tendency is called anthropomorphism and is '*a process of inductive inference, by which humans try to rationalize and predict machines' behavior*' (Epley et al., 2007).

As humans apply human attributes and traits to non-human agents, anthropomorphism also steers their perceptions of these agents. For example, Nass et al. (1995) have found that computers using strong language are perceived as having a dominant personality. Holtgraves et al. (2007) have demonstrated that computers using the first name of the interlocutor as a form of politeness, are perceived as

more skilled. In addition, Tzeng (2004) has revealed that computers apologizing for their mistakes are perceived as more sensitive and less mechanical. Together with anthropomorphism theory, the CASA paradigm has fueled the development of conversational agents (chatbots, avatars, robots) that utilize the same myriad of communicative behaviors that humans use to establish relationships (Fink, 2012). Examples are chatbots that engage in social praise (Kaptein et al., 2011), avatars mimicking head and torso movements (Hale & Hamilton, 2016), and nodding robots (Broadbent et al., 2013). Despite these efforts, conversational agents do not seem to establish satisfactory relationships with customers, which raises several questions (Everett et al., 2017; B. Morgan, 2017; Polani, 2017).

First, it has been questioned whether all of these communicative behaviors work as intended when used by conversational agents (Brandtzaeg & Følstad, 2017). Second, multiple authors have voiced the need to broaden the theoretical lens on relationships with conversational agents in a service context (van Doorn et al., 2017; Marinova et al., 2017; Wirtz et al., 2018). Although communicative behaviors have been acknowledged to play an important role in these relationships (Bickmore & Cassell, 2001), a clear research agenda outlining both current research and avenues for future research is lacking.

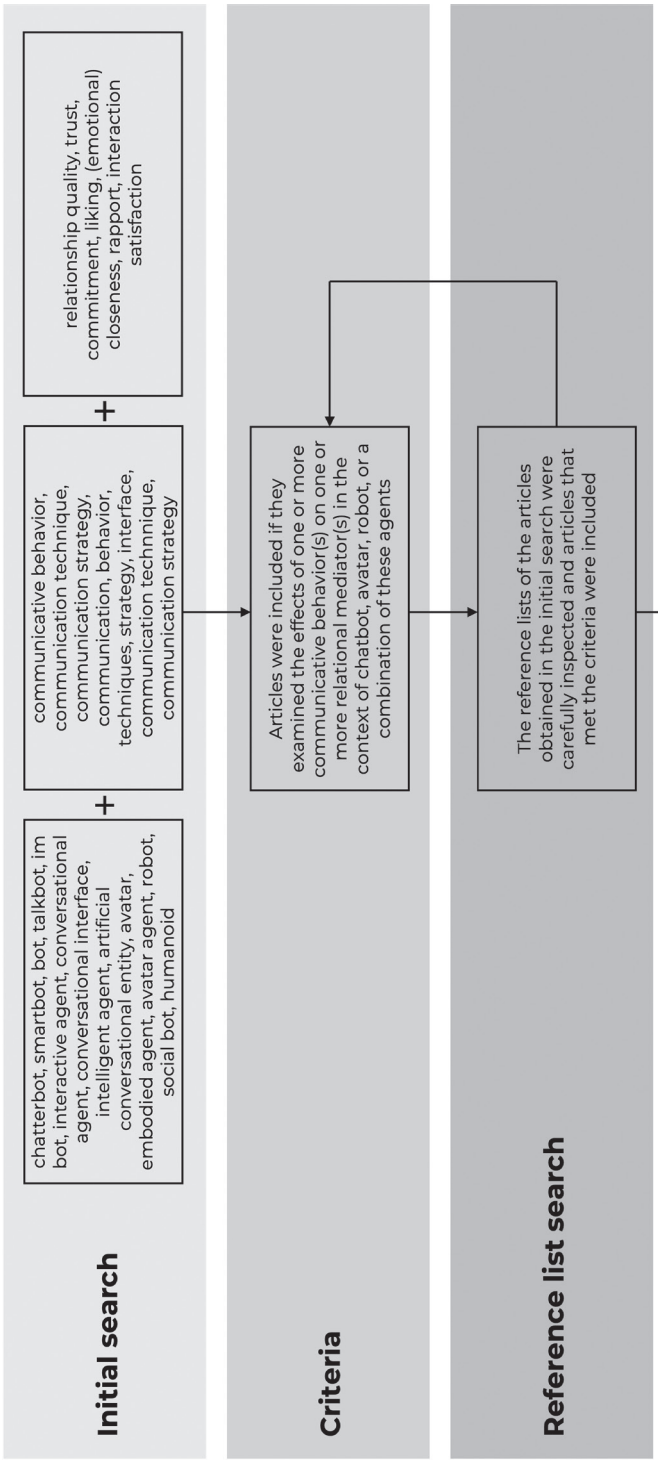
2.3 Methodology

The first step in the current study consisted of identifying relevant studies on the use of human communicative behaviors by conversational agents and its effects on relational mediators and outcomes. The search process is described in the next section and visualized in Figure 2.

2.3.1 The search process and the sample

An initial search in Google Scholar and Web of Science was conducted using a combination of search terms that included terminology for different types of conversational agents, communicative behaviors, and relational mediators. Due to the lack of consensus regarding the definitions of conversational agents, multiple terms for these agents were gathered in the literature and included, see Figure 2 (McTear et al., 2016; Radziwill & Benton, 2017). Regarding the communicative behaviors, the terms 'communication technique', 'communication strategy' and 'interface' were included as well because communicative behaviors are commonly referred to as 'strategies', 'techniques' or 'interface' in the literature on robotics

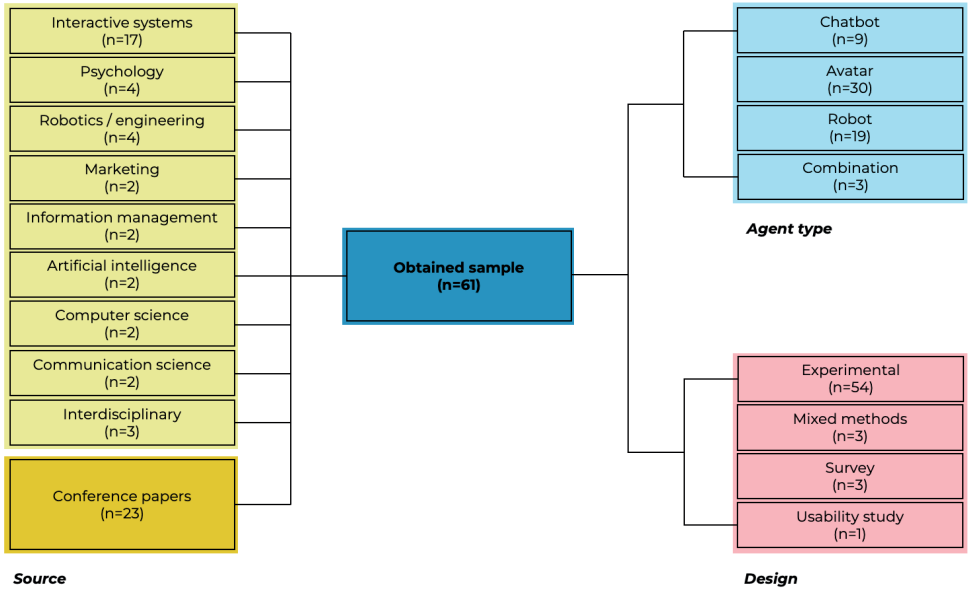
Figure 2 Search procedures



note: References of the included studies are marked with an asterisk in the reference list of van Pinxteren et al. (2020)

and user interface design (B.R. Duffy, 2003; Torrey et al., 2013). Lastly, the search included terms for the relational mediators as specified in Figure 2. Retrieved articles were screened and added to the dataset if they investigated the effects of one or more communicative behavior(s) on one or more relational mediator(s) in the context of chatbots, avatars, robots, or a combination of agent types. An example of an article that was excluded is Cassell and Bickmore (2000), as it did not report the effects of communicative behavior(s) on relational mediators but rather describes how multiple behaviors can be integrated. Other types of literature identified in this search, including dissertations, theses, and conference proceedings, were also included for screening.

Figure 3 Diagram of included studies



Due to the novelty of the topic, the initial search resulted in a small number of articles. Therefore, backward snowball sampling was used to gather more relevant studies (Lecy & Beatty, 2012). The reference lists of the articles obtained in the initial search were carefully inspected and articles that met the criteria were included. The reference list search was an iterative process, so reference list of articles obtained in the snowballing were also inspected until saturation was reached. This approach has several advantages. First, reviews using solely keyword searches are often hampered

by cognitive biases because they are limited to the most common keywords in a particular area (Vieira et al., 2008). In contrast, an analysis of reference lists offers a more comprehensive and objective approach to map literature on a specific topic.

The obtained data set is visualized in Figure 3. The relatively high number of conference papers emphasizes the novelty of this topic across various fields. All studies were published between 1999 and 2018, with 4 studies published between 1998 and 2003, 17 between 2003 and 2008, 17 between 2008 and 2013, and 23 between 2013 and 2018.

2.3.2 A taxonomy of communicative behaviors investigated in conversational agents

Next, an inventory of the independent, mediating and dependent variables was constructed. On average, the experimental studies investigated the effect of 2 independent variables on 4 dependent variables. Regarding mediation effects, 12 out of the 54 experimental studies tested a mediated relationship. Commonly investigated mediating variables included anthropomorphism (Waytz et al., 2014), similarity (Vugt et al., 2010) and social presence (K.M. Lee et al., 2006a; K.M. Lee et al., 2006b). Of the experimental studies, 26 out of the 54 investigated an interaction effect. The most common variables included as moderators were gender (e.g., Kaptein et al., 2011; Siegel et al., 2009), personality (e.g., Cassell & Bickmore, 2000; K.M. Lee et al., 2006b) or the interaction between communicative behaviors (e.g., Kanda et al., 2007). Less common moderators included loneliness (K.M. Lee et al., 2006a) and task difficulty (Stanton & Stevens, 2014).

After creating the above-mentioned inventory of all investigated communicative behaviors, a combination of open and axial coding was used to establish whether categories of behaviors could be distinguished. Following grounded theory (Wolfswinkel et al., 2013), the independent variable(s) of each study was (were) labeled by the researcher using open coding. This analysis entailed that each independent variable received a label describing its main theme on a more abstract level. For example, the label ‘etiquette’ was assigned to the independent variable in Parasuraman and Miller's (2004) study, who manipulated a robot to be either interruptive or impatient. If a study examined multiple communicative behaviors that were different in nature, multiple labels were generated, since grounded theory prescribes literature should be analyzed per theme, not per study (Wolfswinkel et al., 2013). For example, a study by Kaptein et al. (2011) manipulated

Table 1 Taxonomy of communicative behaviors in conversational agents (● = chatbot, ● = avatar, ● = robot, ● = combination)

		Footing			
		Human similarity (26)	**Individual similarity (15)**	**Responsiveness (26)**	**Other (3)**
Modality	Nonverbal behaviors (26)	**Nonverbal behaviors grounded in human similarity** voice ● gaze ●● body movements ●● facial expressions and body movements●●● gaze and body movements ● behavioral realism ● gaze and breathing ● gaze and head movements ● congruency of gestures ●●	**Nonverbal behaviors grounded in individual similarity** response time ● head movements ●● voice ● personality ●	**Nonverbal behaviors grounded in responsiveness** etiquette ● response time ● listening behaviors (nodding) ●● empathic facial expressions ● cooperative gestures ● laughter ●	**Other nonverbal behaviors**
	Verbal behaviors (25)	**Verbal behaviors grounded in human similarity** cognitive recall ●	**Verbal behaviors grounded in individual similarity** communication style ● personality ●	**Verbal behaviors grounded in responsiveness** affect support● social praise ●● politeness ●●●● humor ●●●● communication style ● small talk ●● empathy ● service recovery ● cooperative utterances ● responsive utterances ● social role ●	**Other verbal behaviors** transparency ● argument type ● confidence cues ●
	Appearance characteristics (19)	**Appearance characteristics grounded in human similarity** appearance ●●●●●● facial appearance ●●● physical embodiment ●	**Appearance characteristics grounded in individual similarity** ethnicity ● gender and ethnicity ● physical appearance ● facial appearance ●● physical appearance and environment ● physical presence ●●	**Appearance characteristics grounded in responsiveness**	**Other appearance characteristics** attractiveness ●

both statements of positive feedback and mimicry of response time in a chatbot. Although humans use both of these communicative behaviors to come across more socially intelligent, they tap into different themes and thus received the separate labels 'social praise' and 'response time'.

In order to identify categories of labels, axial coding was applied. More specifically, all labels were compared on similarities and differences and subsequently categorized by two separate researchers. Small differences in axial coding were discussed until agreement was reached. Sometimes a study fell under multiple categories[2]. If this was the case, it received labels in multiple categories. The axial coding resulted in a taxonomy discerning 9 categories in which all studies but four could be placed, see Table 1. The colored dots behind each label indicate which type of conversational agent was investigated in the respective study.

2.4 Findings

As can be seen in Table 1, the two axes that emerged were 'modality' and 'footing'. These two axes will be explained in more detail below.

2.4.1 Modality

The modality axis in the taxonomy classifies the nature of communicative behavior(s) under investigation and distinguishes three categories, namely verbal behavior, nonverbal behavior, and appearance characteristics. In research on H2H communication, modality is considered a particular mode in which communication is expressed (e.g., gestures, eye gaze) and can be used to convey a message or show social conventions (Cassell, 2001). In service management research, it is common to distinguish between two categories of modality, namely verbal versus nonverbal behavior, in which verbal behavior involves written and spoken language, whereas nonverbal behavior does not (vocal sounds that are not words, such as a sigh, are considered nonverbal) (Holmqvist et al., 2017; Sundaram & Webster, 2000). However, in research on H2M interaction, it is more common to make a distinction between verbal behavior, nonverbal behavior, and appearance characteristics, as appearance characteristics can be fully changed in conversational agents, whereas humans can only change them partly. Moreover, a study by Bergmann et al. (2012)

[2] Seven studies received two labels in different categories and one study three. This explains why 70 different labels instead of 61 are displayed in Table 1.

showed that appearance characteristics, such as human-like appearance (vs. cartoonish appearance), have different effects than nonverbal behaviors, such as gestures. Therefore, this distinction was explicitly included in our taxonomy.

2.4.2 Footing

Footing describes the grounds on which communicative behaviors aim to establish relationships. According to Goffman (1979), the way humans interpret the world is determined by the mental structures or 'frames' used. These frames provide the context of how situations or phenomenon are interpreted (e.g., gain or loss frame). For a service encounter, this means that both the customer and the service provider have their own interpretation of the encounter. In social encounters humans present their mental frames to each other by means of communicative choices, for example by using particularly positive or negative words. The alignment of mental frames between the customer and the service provider is what Goffman (1979) calls footing (see also Giles, (2016). This alignment is important because living up to the customers' expectations greatly shapes the perceived quality of the service and the relationship between the customer and service provider (Cronin & Taylor, 1994). During the axial coding, we found that conversational agents employ three broad categories of communicative behaviors to align with the user. These three categories (human similarity, individual similarity, and responsiveness) will now be discussed in more detail.

First, similarity includes all communicative behaviors that aim to make the customer feel more similar to the agent. In our taxonomy we discern two types of similarity, as some behaviors try to achieve similarity to humans in general, for example mimicking a human face (Broadbent et al., 2013), while others focus on similarity to the individual user, for example mimicking the user's face (Vugt et al., 2010). The idea that similarity between a conversational agent and a customer benefits relational outcomes is explained by theories from social psychology. The similarity-attraction theory (Byrne, 1997), the social identity theory (Tajfel, 1974), and the self-categorization theory (Turner & Reynolds, 2011) combine to support the idea that people are attracted to, prefer, and support relationships with similar others. In the field of robotics, however, literature prescribes that although similarity to humans is an important driver of relational outcomes, too much resemblance can hinder these outcomes. For example, the uncanny valley theory (Mori et al., 2012) argues that humans prefer machines similar to humans in appearance and functioning, until a certain tipping point. Therefore, the degree of both human similarity and

individual similarity between a conversational agent and a customer should be chosen with caution.

Responsiveness was the third footing category identified. Responsiveness is defined as '*behaving in a sensitive manner that is supportive of another person's needs*' (Hoffman et al., 2014, p.1) and includes behaviors such as partner affirmation, communal sharing, and social support (Reis, 2007). Perceived responsiveness refers to '*a sense of felt understanding, validation and caring*' (Reis, 2007, p.78). In service encounters, responsiveness can be enhanced by behaviors that signal that the service employee listens and understands the customer, like nodding, expressions of concern and emotion, and asking questions (Maisel et al., 2008). Humans vary greatly in their expression of responsive behaviors, suggesting that responsiveness is not an innate human trait, as opposed to for example memory or movement (Maisel et al., 2008). The idea that responsiveness between a service provider and a customer benefits service outcomes is also supported by research in social psychology. In a relationship context, these behaviors have been found to follow from and foster relationship well-being, but also to decrease sadness and anxiety (Canevello & Crocker, 2010; Maisel et al., 2008). In H2H service encounters, responsive behaviors like listening attentively (de Ruyter & Wetzels, 2000), utilizing a social-oriented communication style (Keeling et al., 2010), or asking questions (Gremler & Gwinner, 2008) have been found to correlate positively with service satisfaction. In conversational agents, such responsive behavior can also be integrated into the interface. For example, Parasuraman and Miller (2004) have manipulated etiquette in a chatbot by changing its tendency to interrupt during a conversation, whereas Keeling et al. (2010) have built an avatar using a social-oriented communication style.

2.4.3 An analysis of significant effects per category

In order to investigate which communicative behaviors yield positive effects when used by conversational agents, the effects of the communicative behaviors in each category of the taxonomy were carefully inspected and noticeable differences and similarities were identified. Categories that contained many positive effects were colored light green in Table 1, indicating that communicative behaviors from these categories yield promising results. Categories characterized by mixed results were colored light yellow. The behaviors in these categories yield some significant results on relational mediators and outcomes, but the effects are more complex

than initially suggested. Categories with less than five studies were considered too empty to draw conclusions. Below, we will first discuss the green cells first, followed by the yellow cells.

Categories with mainly positive effects

All in all, there were three categories of behaviors which showed predominantly positive effects on relational outcomes: appearance characteristics grounded in human similarity, appearance characteristics grounded in individual similarity, and nonverbal behaviors grounded in responsiveness.

Generally speaking, appearance characteristics grounded in human similarity exert positive effects on relational mediators and outcomes (Broadbent et al., 2013; Nowak & Rauh, 2006), particularly when the conversational agent is physically present or even touchable (Bainbridge et al., 2008; K.M. Lee et al., 2006a). Robots thus seem to have an advantage over avatars and chatbots thanks to their physical embodiment. However, if appearance becomes too human-like, users experience an eerie sensation which can cause them to dislike the conversational agent (Bartneck et al., 2007). Furthermore, multiple studies showed that positive effects were only achieved if users' expectations of the robots' behavior, evoked by the human-like appearance, were met (Luo et al., 2006; McBreen & Jack, 2001).

Similarly, appearance characteristics grounded in individual similarity have mainly positive effects on relational mediators e.g., Paiva et al., 2005; Qiu & Benbasat, 2010). Again, these effects were found to be stronger when users experienced feelings of social presence (Qiu & Benbasat, 2010) and identification with the conversational agent (Y. Kim et al., 2012). Although ethnic appearance features that were similar to the individual user did yield positive significant effects, the effects found for gender were mixed, with some studies reporting a preference for agents with the same gender and others reporting the opposite (Qiu & Benbasat, 2010; Nowak & Rauh, 2006). A possible explanation for this contradiction is provided by Powers et al. (2005), who argue that personas play an important role in interactions with conversational agents. Their study showed that women tend to use fewer words to explain dating norms for females to a female robot compared to a male robot. This finding suggests that the gender of the robot, as inferred by appearance, activates a persona which in turn affects user perceptions.

Finally, the category nonverbal behavior grounded in responsiveness, which included behaviors such as gaze and nodding, was also found to yield significant positive effects (Gratch et al., 2007; Kaptein et al., 2011). For example, Kanda et al. (2007) showed that a robot performing behaviors that signal active listening behavior, including nodding and making eye contact, was evaluated more positively than its non-listening counterpart. Other nonverbal forms of active listening, including prompt response time, were found to affect user evaluations of intelligence, friendliness, and liking (however only for females) (Kaptein et al., 2011). Parasuraman and Miller (2004) even found that good etiquette, manipulated as not interrupting the interlocutor, could overcome the negative effects caused by the otherwise unreliable behavior of a chatbot.

For practitioners who wish to optimize interactions between conversational agents and customers, implementing communicative behaviors from one of the above-mentioned categories appears to be a relatively safe and effective option. However, they should take heed of the uncanny valley effect and possible interactions between communicative behaviors and the gender of both the customer and the conversational agent. We will return to this in the section on managerial implications below.

Categories with mixed results

There were also three categories which showed mixed results: nonverbal behaviors grounded in human similarity, nonverbal behaviors grounded in individual similarity and verbal behavior grounded in responsiveness.

Regarding the category nonverbal behaviors grounded in human similarity, effects on relational mediators and outcomes were largely dependent on other variables. For example, Van den Brule et al. (2014) demonstrated that gestures performed by a robot enhanced user trust, however, only if the gestures were predictive of the robot's behavior. In addition, Cowell and Stanney (2005) found that users interacting with an avatar demonstrating trusting facial expressions, like eye contact and paralanguage, trusted the avatar more than users interacting with an avatar lacking these nonverbal behaviors. However, there was no concordant increase in perceived trust if the avatar was able to change its posture and gestures over time. Krämer et al. (2007) found positive effects of gestures in a study that demonstrated

that when an avatar showed self-touching behaviors, such as scratching itself, it was perceived more positively than its non-gesturing counterpart.

An explanation of the mixed effects of different body movements is provided by Pejsa et al. (2015). According to this study, coordinated movements of the eyes and head enable an avatar to convey more information and establish a stronger affiliation with the user, whereas upper body movement enables the avatar to grab the user's attention and direct it through the environment. In line with this, Stanton and Stevens (2014) found that a robot demonstrating gaze movements increased users' trust in the robot, however only when the robot helped to carry out a difficult task. This finding suggests that in contrast to facial movements, body movements do not serve relational purposes. Another explanation might lie in the congruency of the movements with other communicative behaviors. Salem et al. (2011) found that the effects of gesturing on liking and intentions to use the robot again, were particularly pronounced if the robot's gestures were incongruent with its speech for half of the time. Similar results were obtained by Groom et al. (2009), who found that users liked an avatar more when it moved in sync with its speech at some times and out of sync at others. These results seems to indicate that especially unexpected gestures induce positive perceptions of the conversational agent. However, implementing such features should be done cautiously, as incongruence in gestures was also found to hinder task performance (Salem et al., 2013). On a related note, Von der Pütten et al. (2010) demonstrated the importance of these features being implemented realistically in a certain conversation. Features that do not make sense at all negatively impact users' evaluations of the agent.

For nonverbal behaviors grounded in similarity to the individual, the effects on relational mediators and outcomes were also mixed. For example, Siegel et al. (2009) manipulated a robot's gender, using its voice and found users rate the voice of the opposite sex instead of the same sex as more credible, trustworthy and engaging. Therefore, customers seem to prefer a robot that is dissimilar to them in terms of gender. For personality, however, Kwan Min Lee et al. (2006b) found that similarity to the user in loudness and facial expressions increased enjoyment. Furthermore, when looking at movements in particular, results were mixed and dependent on the type of movements mimicked. For example, Bailenson and Yee (2005) found that users had a more positive perception of an avatar when it mimicked the user's pitch, jaw and eye movements. However, a study by Hale and Hamilton (2016) only found weak effects of mimicry of the torso and head on rapport.

Finally, verbal behaviors grounded in responsiveness, such as affect support and social praise, had positive effects on relational mediators including liking, but only under particular circumstances (Bickmore & Cassell, 2001; Derrick & Ligon, 2014; Klein et al., 2002; Kulms et al., 2014). For example, Derrick and Ligon (2014) showed that male and female users differ in their preferences for social praise used by an avatar. Whereas ingratiation techniques, such as self-presentation, increased liking of the avatar for men, self-promotion increased the attractiveness of the avatar for women. Furthermore, Strait et al. (2014) showed that a robot using polite speech is perceived as more considerate and likable, however only when evaluated by a bystander and not by the direct user. In addition, Cassell and Bickmore (2003) found small talk is an important driver of trust in avatars, however only for extrovert users. Lastly, Min Kyung Lee et al. (2010) demonstrated service recovery strategies were successful in reducing the negative impact of a robotic breakdown. However, users with a relational orientation responded best to an apology, while those with a utilitarian orientation responded best to compensation.

The use of humor was also placed under verbal responsiveness, as it also conveys empathy (Hampes, 2010). However, it is difficult to make clear statements on its effectiveness, as humor is very personal. In general, humor used by conversational agents had positive effects on relational mediators such as trust and liking (e.g., Mirnig et al., 2017). For example, Sjöbergh and Araki (2009) showed that a joke was perceived as funnier when told by a robot, than when users read the joke by themselves. Furthermore, in a study by Niculescu and Banchs (2018), a chatbot telling fun facts was compared to a non-humorous counterpart and found to be liked more. Humor was also found to have negative effects under some conditions. For example, Tay et al. (2016) found that non-disparaging jokes are liked more when told by a human, whereas disparaging jokes are perceived as less disgusting when told by a robot. Humor, therefore, can help establish relationships, but certainly not all types of humor are appropriate for this.

The categories showing mixed results are probably more interesting for academics than for practitioners, as they point at the existence of important moderators such as personal preferences or personality characteristics. More attention will be devoted to these behaviors when we present the research agenda in the section on theoretical implications below.

2.4.4 An analysis of potential additional behaviors from the H2H literature

The overview of communicative behaviors investigated in conversational agents (see Table 1) allowed us to conduct a targeted search in the literature on H2H service encounters for additional, thus far 'overlooked' behaviors that could be investigated in H2M interactions. Considering the magnitude of H2H literature, we restricted our search to review articles. We searched Google Scholar and Web of Science for review articles on the effects of communicative behaviors displayed by service employees on one of the relational mediators mentioned in Figure 2. The search yielded three review studies and one overview paper based on the critical incident technique.

The first review article used for comparison was a review by Boles et al. (2000) on the communicative behaviors service employees utilize to build relationships with customers. The second review was by Swan et al. (1999), who specifically focused on how service employees build trust relationships. Lastly, the third review by Gremler and Gwinner (2000) and the overview article by Gremler and Gwinner (2008) both investigated how service employees establish rapport in H2H service encounters. The labels in Table 1 were compared to the communicative behaviors mentioned in these four articles and potential additional behaviors were noted down. Below, we discuss which 'overlooked' behaviors we identified. First, we will do this for the categories that were relatively underresearched in the H2M literature (fewer than 5 labels in Table 1), with the exception of the category appearance characteristics grounded in responsiveness. For this particular category, as no overlooked behaviors were obtained from the H2H literature. Thereafter, we will also provide some additional suggestions for the other categories.

Overlooked behaviors for categories containing fewer than 5 labels

First of all, in our taxonomy only one article belonged to the category verbal behaviors grounded in similarity to humans: Richards and Bransky's (2014) study on cognitive recall, in which recall was found to increase both the user's enjoyment of interacting with the agent and the believability of the character over multiple service encounters. Therefore, expressions that signal other human cognitive processes, such as thinking out loud (e.g., 'let me think', 'I was thinking') and processing (e.g., 'please give me a second to process that') verbatim, might also

be interesting to investigate in future research. The use of such expressions to establish relational outcomes is in line with the idea put forward in by Gremler and Gwinner (2008) that being attentive to the customer helps to build rapport.

Secondly, studies that aim to establish relationships through human-like appearance characteristics, primarily seemed to focus on conversational agents having a human-like (instead of a cartoon-like) appearance (e.g., Parise et al., 1999; Bartneck et al., 2009a), and in particular on having a human-like face (e.g., Broadbent et al., 2013). Although not many other appearance characteristics are mentioned in the H2H literature, Gremler and Gwinner (2008) do refer to a study by Wood (2006) who shows that appropriate attire can influence customer perceptions of expertise and thereby trust. Furthermore, Swan et al. (1999) mention the importance of appearance in coming across as competent and benevolent. Therefore, future research might investigate more specific and detailed appearance cues, such as attire, build or posture, in conversational agents.

Third, the studies in the taxonomy that investigated nonverbal behaviors grounded in individual similarity particularly focused on head movements (Bailenson & Yee, 2005; Hale & Hamilton, 2016) and voice cues which signal similarity in terms of gender (Siegel et al., 2009) or personality (K.M. Lee et al., 2006b). However, Gremler and Gwinner (2008) mention various other nonverbal behaviors that when mimicked accordingly, have been found to foster rapport with customers in service encounters. These behaviors include posture, speech rate, gestures, breathing patterns, and facial expressions.

Finally, studies looking at behaviors that establish relationships through individual similarity in verbal communication were scarce in the taxonomy. Only communication style (Li & Mao, 2015) and personality (introvert or extrovert voice) (K.M. Lee et al., 2006b) were investigated in this category. Although these variables seemed to increase engagement and enjoyment, individual verbal language use can be mimicked in many more ways (Gremler & Gwinner, 2008). Consider for example 'linguistic mimicry' or mimicry of individual word usage, which has been found to help to develop positive relationships between customers and salespersons. A related, but different concept called 'linguistic style matching' (the use of certain types of function words in similar frequencies) has also been found to play an important role in relationship initiation and stability (Ireland et al., 2011). Furthermore, Gremler and Gwinner (2008) mention common grounding behaviors,

which are verbal conversational techniques to establish common ground with the user. These techniques include for example pointing out similarities in lifestyle or interests.

Overlooked behaviors for categories containing more than 5 labels

First, in our taxonomy we found that communicative behaviors in conversational agents that aim to establish similarity with humans primarily focus on nonverbal behaviors. However, several nonverbal behaviors investigated in the H2H literature remain overlooked. According to Sundaram and Webster (2000), communicative nonverbal behaviors are divided into paralanguage, kinetics (e.g., movement) and proxemics (e.g., distance). Research on nonverbal behaviors in conversational agents focused mainly on kinetics and less on paralinguistic cues such as loudness, rate, pitch, and proxemics, all of which could be interesting avenues for future research.

Research on communicative behaviors grounded in responsiveness is strongly focused on verbal behaviors. In the nonverbal category only a few behaviors, including cooperative gestures and listening behaviors such as nodding can be found (e.g., Gratch et al., 2007; Kanda et al., 2007). This gap provides an opportunity for future research as Gremler and Gwinner (2008) identify several other responsive nonverbal behaviors. For example, a reference is made to a study by Wood (2006) who showed that a friendly smile is an important communicative cue to increase perceived trustworthiness. Furthermore, nonverbal displays of empathy with the customer are considered crucial for establishing rapport (Gremler & Gwinner, 2000), but remain largely unexplored in the H2M literature. Therefore, future research might want to investigate the effects facial expressions of care and concern in avatars or humanoid robots.

Most studies in the category of verbal responsiveness focused on politeness (Portela & Granell-Canut, 2017) or humor (Torrey et al., 2013). However, perceptions of politeness can be induced by other behaviors than those mentioned in the taxonomy. Examples include expressions of cheerfulness or unexpected honesty (Gremler & Gwinner, 2008). Besides politeness, humor was found to be another commonly investigated behavior. Although humor is mentioned by Gremler and Gwinner (2008), the authors point out the importance of (mutual) laughter in service encounters and not only humor per se. In addition, it is also mentioned that humor should be related to the service situation. These might be useful additions for the investigation of humor

in conversational agents. Furthermore, Gremler and Gwinner (2008) mention that empathy does not only include expressions of care, but also expressions that signal an understanding of the problems of the customers, which they refer to as 'cognitive empathy'. Furthermore, these expressions can be strengthened by important back-channel responses including 'um-hmms' to induce perceptions of listening and thereby influence rapport (Gremler & Gwinner, 2008).

2.5 Discussion

Given the reluctance of customers to engage with conversational agents, the question has been raised which communicative behaviors, if any, conversational agents can use to build better relationships (Brandtzaeg & Følstad, 2017). This study aims to answer that question by creating both an overview of communicative behaviors that have already been investigated in conversational agents and their effects, as well as a research agenda that points to overlooked communicative behaviors and thought-provoking findings in existing studies that call for further research.

Taken together, the findings of our literature review show that the use of certain communicative behaviors by conversational agents has significant positive effects on relevant relational mediators and outcomes such as intention to use, word of mouth, loyalty or increased cooperation (e.g., Richards & Bransky, 2014; Waytz et al., 2014). Other behaviors, however, show effects that are less clear and straightforward as one would expect based on anthropomorphism theory (Epley et al., 2007) or the CASA paradigm (Nass & Reeves, 1996). Furthermore, several communicative behaviors that had already been identified in the literature on H2H service encounters have not yet been investigated in conversational agents. These communicative behaviors offer promising opportunities for future research, which are described in the next section.

2.5.1 Theoretical implications: A research agenda

This study has several theoretical implications. First, conducting research on conversational agents in a service setting requires a multidisciplinary approach, including theories and previous research from the field of artificial intelligence, robotics, psychology, service management, communication science, and others. This is the first study to analyze studies from different subdisciplines and draw

up a taxonomy that allows comparison across fields, categories of communicative behaviors and different types of conversational agents. Using this taxonomy, researchers who are interested in the impact of AI on services can conduct more targeted research into the communicative behaviors that can be implemented in conversational agents to enhance the overall customer experience.

More specifically, we advise researchers to focus on (1) categories of communicative behaviors that show mixed results in our review and (2) communicative behaviors from the H2H literature that have not yet been investigated in conversational agents. With respect to (1), several complexities emerged from our research. First and foremost, user characteristics such as gender (Derrick & Ligon, 2014), personality (Cassell & Bickmore, 2003) or relationship orientation (M.K. Lee et al., 2010), have been shown to interfere with the intended effects of communicative behaviors used by conversational agents. This interference is particularly salient for verbal behaviors grounded in responsiveness. For example, Derrick and Ligon (2014) showed that men and women have different preferences for the use of social praise by conversational agents and Cassell and Bickmore (2003) showed that small talk evokes trust in extroverts but not in introverts. Therefore, these findings suggests that humans differ not only in their responsiveness towards others, but also in their receptiveness for responsiveness from others. Initial attempts to map user expectations and preferences can be found in usability studies like Baron (2015); it is desirable that more research is conducted in this area. For example, experimental research could investigate how preferences of specific user groups, such as users with high and low affinity for technology, moderate the effects of particular communicative behaviors. Furthermore, the interplay between appearance characteristics and verbal and nonverbal behaviors should be explored further, as some studies show that accommodating a conversational agent with human-like appearance characteristics also increases user expectations of the agent's verbal or nonverbal behavior (e.g., Luo et al., 2006; McBreen & Jack, 2001).

In the H2H literature, several potential additional behaviors are mentioned that have not yet been investigated in conversational agents. The full overview was provided in the results section, but we will highlight a few particularly promising ones here: mimicry of language use or communication style, mimicry of gestures, posture, speech rate or facial expressions, the use of common grounding behaviors, the use nonverbal expressions of empathy, and the use of back-channel responses that signal active listening.

2.5.2 Managerial implications: Communicative behaviors worth considering

The systematic review reported in this study sheds more light on the effects of communicative behaviors in conversational agents, which can help service managers enhance the experience of customers interacting with conversational agents. In the green cells in Table 1, several behaviors are mentioned which have been shown to have positive effects when used by conversational agents. These behaviors include (but are not restricted to) human-like appearance, similarity in appearance to the customer, the use of etiquette, the use of cooperative gestures, and the use of laughter. However, even for some of these behaviors, implementing them can come at a cost, such as decreased task performance by the user (Salem et al., 2013), attention shifts (Pejsa et al., 2015), or the activation of undesirable personas (Powers et al., 2005). Therefore, we strongly advise service managers to carefully consider whether the ends justify the means.

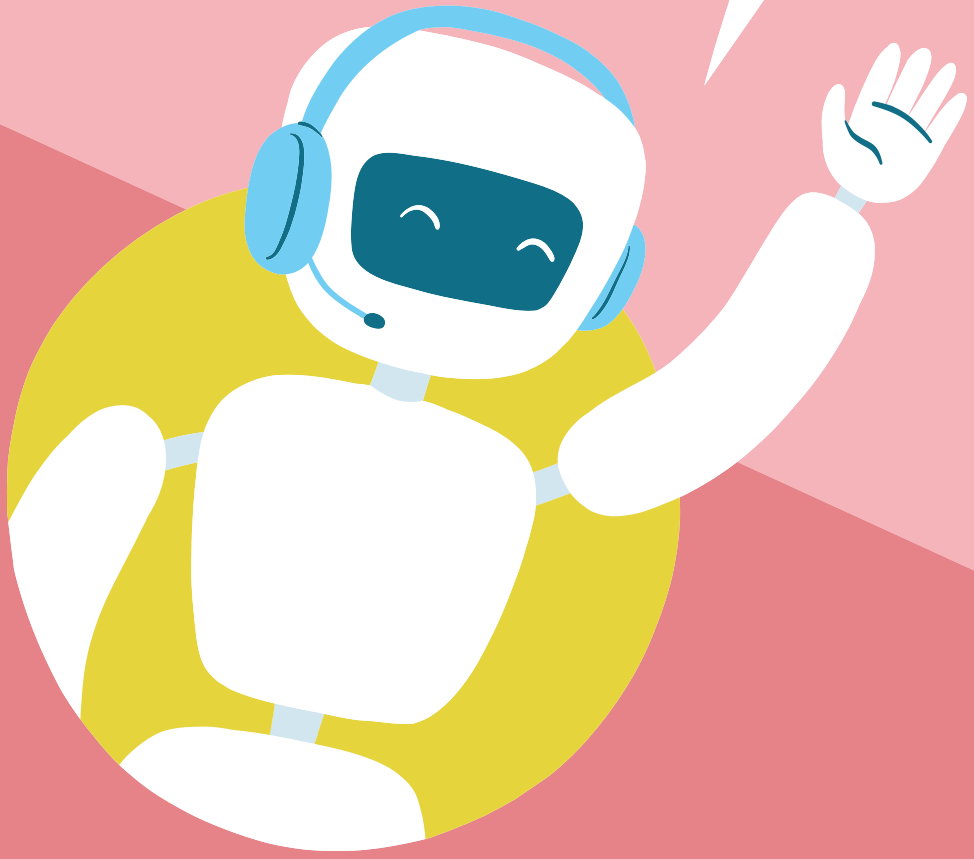
2.5.3 Limitations

Of course, this study also has some limitations. Firstly, this literature review is a snapshot of a research field that is in flux. Technological innovations are moving faster than ever before, which implies that the practical state of the art might be already one step ahead. We hope this overview and research agenda encourage scholars to shed more light on ongoing developments.

Second, we have combined research on chatbots, avatars, and robots under the common denominator of conversational agents. Although there is theoretical justification to do so, this approach may have oversimplified the differences between agent types. For example, the effects of communicative behaviors tested in a robot cannot be seen in the absence of its physical embodiment. Therefore, it is hard to compare the effects of similar communicative behaviors between different agent types.

Third, we used review articles as a basis for comparison between the H2M and the H2H literature. Suitable review articles were scarce, which suggests that a more detailed analysis of individual studies could have provided a more complete picture. Nevertheless, we hope to have provided a useful framework for such a comparison and encourage other authors to extend our work with more specific studies in the future.

CHAPTER 3
DESIGNING VIRTUAL SERVICE AGENTS: A CREATIVE APPROACH FOR UNCOVERING USERS' COMMUNICATIVE NEEDS



3.1 Introduction

In recent years, service firms have increasingly been deploying virtual service agents (VSAs) in their service encounters to substitute or augment human service employees (Belanche et al., 2020). VSAs are computer-generated characters or avatars that can interact with users using natural language and human-like communicative behaviors, such as smiling, nodding, or a social communication style (Cassell et al., 2000). Following the Computers As Social Actors paradigm (Nass et al., 1994), scholars have argued that these abilities enable VSAs to provide a human-like interactional experience, which in turn enhances relational outcomes in users (Huang & Rust, 2021; Wirtz et al., 2018). As a result, this paradigm has fueled the development of VSAs that resemble humans in appearance as well as verbal and nonverbal behaviors (Feine et al., 2019; Seeger et al., 2017). However, there is increasing evidence that when it comes to incorporating human-like communicative behaviors (HCBs) in VSAs, more is not always better and one-size does not fit all. As described in detail in chapter 2, not all HCBs have a positive effect on relational mediators and outcomes and their effects may depend on the characteristics of individual users (Derrick & Ligon, 2014; Krämer et al., 2018). Furthermore, chapter 2 also showed that communicative behaviors are often studied in isolation, even though their effects are known to interact.

Existing research provides designers with limited guidance on how to effectively incorporate human-like communicative behaviors into the operating procedures of VSAs. This has several reasons. First, the few studies on users' preferences regarding human-like communicative behaviors focus on specific behaviors or appearance characteristics, such as gender, realism, facial characteristics, or communication style (Komatsu & Kamide, 2017; Li & Mao, 2015; Payne et al., 2013). However, as the various behaviors and characteristics have been shown to influence each other, it would be more useful to investigate users' preferences for a combination of characteristics and behaviors (Luo et al., 2006). Furthermore, current studies do not look into the needs that underlie these preferences, and as such, fail to uncover tacit and latent communicative needs that users may have (Sanders & Stappers, 2012). Although warmth and competence are often studied and mentioned in the literature as users' needs for conversational agents, they were not derived from an in-depth analysis of users' needs in human-to-machine communication (Bergmann et al., 2012; S.Y. Kim et al., 2019; Van Doorn et al., 2019). Third, most studies investigate users' preferences in one particular service context, while research has

shown that these preferences can differ between service contexts (Li & Mao, 2015). Finally, users' preferences are often treated as a static concept, yet they tend to change throughout the service interaction. This temporal dimension of users' preferences is barely taken into account in earlier studies (Følstad & Kvale, 2018; Lemon & Verhoef, 2016).

This study aims to address these limitations by: (1) presenting a methodology based on the principles of generative design (Sanders & Stappers, 2012) that allows designers to uncover design rules by leveraging the creativity of users, and (2) using this methodology to investigate how and where users' preferences for appearance characteristics and human-like communicative behaviors in VSAs differ between service contexts and phases of the service interaction. The contributions of this study are therefore both practical and theoretical. From a practical perspective, this study will provide concrete guidelines for designers of VSAs that acknowledge the differences between service contexts and phases of the service interaction. From a theoretical perspective, this study will provide more insight into the needs that underlie users' preferences regarding human-like communicative behaviors in VSAs. By combining insights from research on creativity and human-centered approaches to design, this study also addresses the need for more suitable methods to study user preferences regarding VSAs (Larivière et al., 2017). More specifically, the generative design approach used in this study combines in-depth interviews with a VSA generator ('FaceMaker') and generative card activities to elicit users' tacit and latent knowledge on their communicative needs (Sanders & Stappers, 2012; Schwind et al., 2017). We hope that this methodology will inspire designers and scholars who wish to address such users' needs in designing service encounters with VSAs or other conversational agents.

3.2 Literature review

3.2.1 Communicative behaviors in VSAs

In human-to-human service encounters, both the appearance characteristics and the communicative behaviors of the service agent are crucial to the overall success of the service interaction (Gabbott & Hogg, 2000; Nickson et al., 2005; Palmatier et al., 2006). Whether online or offline, service encounters typically include some sort of interaction that influences users' perceptions of the service employee (e.g., in terms of friendliness or competence). In turn, users' perceptions of the

service employee are important, as they affect relational mediators such as trust and rapport, which in turn influence intention to use, word of mouth, loyalty, and cooperation (see chapter 2). However, the rapid developments in technology in general, and artificial intelligence in particular, are fundamentally changing the nature of services (Larivière et al., 2017). Specifically, technology infusion, which is defined as '*the incorporation by service organizations of technological elements into the customer's frontline experience*', is becoming more and more prevalent in the service landscape (van Doorn et al., 2017, p.43). Technology infusion entails that human service employees are increasingly augmented or substituted by technology, which has raised the question among service scholars whether technological artifacts can deliver the same interactional experience and thereby establish relational outcomes with users (Huang & Rust, 2018; van Doorn et al., 2017).

With their ability to resemble humans in both appearance and communicative behaviors, VSAs have been put forward as a promising technology to create human-like service interactions (Huang & Rust, 2021; Verhagen et al., 2014). The promise of VSAs is substantiated by anthropomorphism theory, which posits that humans tend to attribute essential human traits, such as feelings or rational thought, to non-human agents who display human-like cues (Epley et al., 2007; Y. Kim & Sundar, 2012). Consider for example a VSA that makes empathic facial expressions or displays happiness (Lisetti et al., 2013; Söderlund & Rosengren, 2008). Perceiving these cues will activate users' knowledge of human interaction patterns, which enhances the likelihood that the communicative behaviors of the VSA have the same effect on relational outcomes as they would have had if the service agent had been human. Unsurprisingly, anthropomorphism theory has fueled the development of VSAs that resemble humans in appearance and verbal and nonverbal behaviors (Feine et al., 2019; Seeger et al., 2017).

3.2.2 The moderating role of users' needs

Despite strong evidence that users tend to anthropomorphize VSAs (Feine et al., 2019; Seeger et al., 2017), earlier studies that have tested the effects of human-like communicative behaviors in VSAs have not always yielded positive results (see chapter 2). Rather, more and more studies seem to suggest that the effects of HCBs in VSAs are moderated by user characteristics (Chattaraman et al., 2019; Derrick & Ligon, 2014; Krämer et al., 2018; van Pinxteren et al., 2019). For example, user gender has been shown to moderate the effects of self-promotion and

ingratiation techniques on the likeability of an avatar (Derrick & Ligon, 2014). In addition, user extroversion was found to strengthen the positive effect of small talk on trust (Cassell & Bickmore, 2003). A possible explanation for these findings is that communicative needs and preferences differ between male and female users of VSAs, or between introvert and extrovert users. Some studies have also looked into the impact of users' needs more directly. For example, Chattaraman et al. (2019) showed that a VSA utilizing a social-oriented communication style is more effective in enhancing perceptions of two-way interactivity and trust than a task-oriented VSA, however, only for users with a low need for task assistance.

Although these findings are in line with a three-factor theory of anthropomorphism (Epley et al., 2007), which acknowledges that users' motivation to anthropomorphize is dependent on their needs, they do paint a rather complicated picture for designers. How can they create VSAs that meet users' communicative needs, if these needs differ so strongly between individual users? Since needs are relatively complex and dependent on various contextual factors, a systematic exploration of users' needs is crucial for the successful design and employment of VSAs. Therefore, we will now turn our attention to two factors that are known to influence users' communicative needs in human-to-human service encounters: the service context and the different phases of the service interaction.

3.2.3 Users' needs and the service context

A core characteristic of services is that the product is not so much the outcome of the production process (e.g., advice), but rather the production process itself (Grönroos, 1998). Despite this shared core characteristic, services vary widely in nature. Many scholars have differentiated between hedonic-dominant and utilitarian-dominant services (Dhar & Wertenbroch, 2000; Jiang & Wang, 2006). Utilitarian-dominant services comprise mostly functional and rational aspects, while hedonic-dominant services comprise more emotive, experiential, and sensory aspects (Jiang & Wang, 2006). For example, health care services are more experiential and emotive in nature than financial services, and are therefore classified as hedonic (Hellén & Sääksjärvi, 2011). The distinction between hedonic and utilitarian services has important implications for service design, as users' needs have been found to differ between the two types of service contexts. Generally, users seem to prefer communicative cues in the design of the service that are aligned with the service context (Andreu et al., 2015). More specifically, rational communicative cues are more appropriate in

utilitarian service contexts, while emotional communicative cues have been found to be more appropriate in hedonic service contexts. Similarly, Jiang and Wang (2006) have found that user pleasure has a stronger effect on perceived service quality in hedonic service contexts than in utilitarian service contexts. Therefore, communicative behaviors that induce pleasure in users (e.g., the use of humor or laughter) are probably more effective in hedonic service contexts, but this expectation has not yet been investigated in the context of VSAs.

3.2.4 Users' needs and the phases of the service interaction

Service interactions tend to follow a more or less fixed structure, which is commonly referred to as 'the service script'. The service script specifies the temporal sequence of events that together comprise the service, as well as the behavior that is expected from the service employee and the customer in different phases of the sequence (Chan & Chandra-Sagaran, 2019). Service scripts help employees and users in determining which behaviors, sequences and roles are appropriate (Goffman, 1978), and as such, have a large impact on users' expectations and perceptions of quality (Sands et al., 2021).

As services differ in both nature and context, service scripts come in many different forms. What they appear to have in common, however, is that they consist of roughly three phases: the pre-process phase, the in-process phase, and the post-process phase (Dube-Rioux et al., 1989; J.H. Kim, 2011; Noone et al., 2009). During the pre-process phase, all preliminaries occur, such as the exchange of information needed for the provision of service. During the in-process phase, the main purpose of the service interaction is accomplished, such as receiving advice. During the post-process phase, finally, all activities take place that are necessary to end the interaction, such as sending a confirmation or greeting the customer.

Previous research suggests that even in highly scripted services such as ordering and receiving fast food, certain 'goodwill acts' such as greeting, thanking, and bidding goodbye are desired by users (Chan & Chandra-Sagaran, 2019). In more prolonged service interactions such as hairdressing appointments, service providers and users generally spend more time talking about social conversation topics than about the service itself (Garzaniti et al., 2011). What these two service scenarios have in common, however, is that the social- and task-oriented elements

of the conversation are linked to specific events in the service script; They are not spread randomly across the service interaction. Therefore, it makes sense to assume that the communicative needs and preferences of users are not static, but differ between the various phases of the service interaction.

Based on the findings discussed in this chapter, we opted for a research design that allowed us to uncover the communicative needs of potential users of VSAs while taking into account the moderating effects of personal characteristics, service context, and phase of the service interaction. The next chapter provides more information about this methodology.

3.3 Methodology

3.3.1 Procedure

Within the field of service design, there is a growing consensus that the success and sustainability of services depend on the value they create for users (L. Anderson et al., 2013; Ostrom et al., 2015). As a result, the last decade has witnessed an increase in human-centered design approaches that allow users to participate in the design of a service, a practice which is theorized to provide better access to user experiences and thereby improve idea generation (Sanders, 2000; Steen et al., 2011). Traditional human-centered design approaches often use qualitative techniques (e.g., interviews or observations) that provide mainly explicit or observable knowledge. However, users' needs also constitute knowledge that is difficult to express (tacit) or has not yet been consciously experienced (latent). Therefore, generative design techniques have been developed to further enrich the information obtained in human-centered research (e.g., Enninga et al., 2013; Peters et al., 2020; Sleeswijk Visser, 2009). Generative techniques leverage the creativity of participants, enabling them to become aware of and express their thoughts and feelings, also if these thoughts and feelings were previously tacit or latent. According to Lavender et al. (2020), this makes generative techniques particularly useful to uncover communicative needs.

In this study, participants were actively involved in the design of a VSA. They were provided with generative tools that could help them in expressing preferences for both appearance characteristics as well as verbal and nonverbal behaviors displayed by the VSA (Sanders & Stappers, 2012). For the appearance characteristics, participants were allowed to work with the web-based avatar

generator 'FaceMaker', which was developed and validated by Schwind et al. (2015, 2017). This generator displays a 3D model of a Caucasian average face, which can be adjusted using 37 sliders (design parameters) divided over eight categories such as 'mouth', 'nose', or 'eyes'. In addition, a storyline toolkit with generative cards was developed that allowed participants to indicate their preferences for verbal and nonverbal behaviors in different phases of the service interaction (Sanders, 2000). During the entire design process, in-depth semi-structured interviews were conducted to uncover users' tacit and latent needs by discussing the motivations behind their preferences. The research protocol consisted of four steps, which are described below.

Step 1. Sensitizing, past and current experience. In the first step, participants were shown different pictures of VSAs and interviewed about their past and current experiences with VSAs. This interviewing method is called '*sensitizing*' and was used to familiarize participants with VSAs and make them more sensitive towards their memories and associations regarding VSAs (Sleeswijk Visser, 2009).

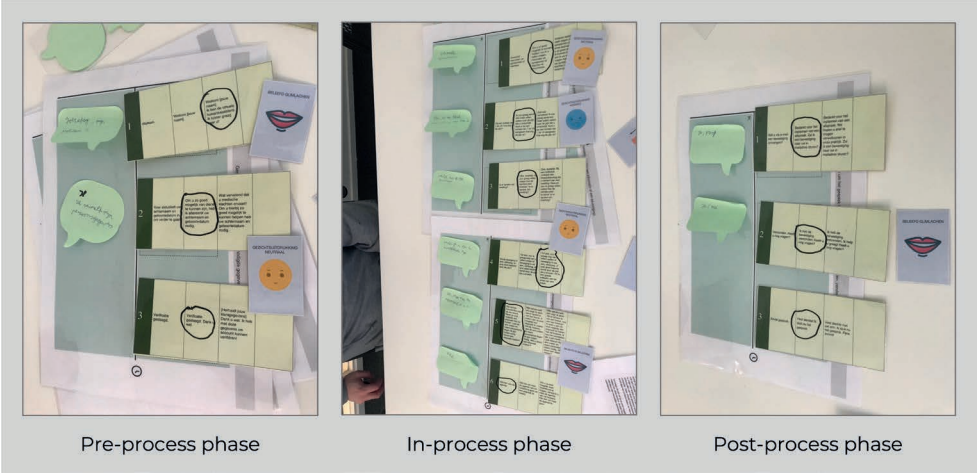
Step 2. Designing the VSA's appearance. In the second step, participants were instructed to carefully read a scenario in which they had to imagine that they wanted either tax advice or medical advice. Subsequently, they were asked to create a virtual tax advisor or virtual GP assistant that best suited their preferences, using the avatar generator FaceMaker (Schwind et al., 2017). As a baseline, participants were presented with an average Caucasian face (Schwind et al., 2015). Thereafter, participants were given roughly ten minutes to alter the baseline avatar to match their preferences. To do this, participants could use 37 sliders that each altered one parameter of the face. Sliders were grouped into eight categories and participants were instructed to start with the category '*general*'. The other categories were '*nose*', '*outer face parts*', '*eyebrows*', '*cheeks and jaw*', '*mouth*', '*eyes*', and '*makeup*'. When the participants indicated they were finished, they were asked to share their screen and were interviewed about their design choices and motivations for these choices.

Step 3. Designing the VSA's verbal and nonverbal behavior. In the third step, participants were instructed to create a timeline mapping of the VSA's verbal and nonverbal behaviors using generative cards (Sanders, 2000). Following Noone et al. (2009), the timeline was split up into a pre-, in-, and post-process phase to account for the sequential nature of the service interaction. Each phase comprised

several turns for which participants could choose between three expressions from a verbal expression card, or come up with an expression of their own. For every turn, the three pre-determined expressions ranged from not social to very social and were based on earlier research (Chattaraman et al., 2019; van Dolen et al., 2007). In addition, participants could select nonverbal behaviors (e.g., head movements, facial expressions, and body movements) from a pile of nonverbal expression cards if they found these appropriate for the turn. After every turn, participants were asked to elaborate on their choices and motivations for these preferences. An example of a timeline mapping is shown in Figure 1.

Step 4. Survey. In the fourth step, participants were asked to fill out a survey. The objective of the survey was to collect demographic and personal information from the participants that has previously been found to moderate communicative needs and preferences. The survey included questions about age, gender, personality (Jani & Han, 2014), affinity for technology (Geissler & Edison, 2007), and preferences for social-oriented communicative behaviors (van Dolen et al., 2007).

Figure 1 Example of a timeline mapping of the VSA's verbal and nonverbal behaviors using generative cards



3.3.2 Sample

The study was conducted in February and March 2021. A combination of convenience and snowball sampling was used to recruit participants that varied in gender, age, occupation, and previous experience with VSAs. A total of 20

participants participated in the study, ten of whom identified as male and ten as female. The age of the participants ranged from 20 to 52 years old (*M* = 27.80, *SD* = 8.50). Regarding occupation, 8 participants were students and 12 worked full-time.

3.3.3 Analysis

The study yielded four sources of data: 1) the facial parameters of the VSA, 2) the timeline mappings, 3) the participants' responses during the in-depth interviews, and 4) the survey data. First, the facial parameters included 37 measurements for each participant that were analyzed to gain more insight into users' preferences concerning the VSA's appearance. The parameters were standardized and averaged to create the average face per service context and analyzed for commonalities and differences. Second, the timeline mappings were analyzed to gain more insight into users' preferences for verbal and nonverbal behaviors. This was done by looking at the frequencies of the chosen generative card per turn, phase of the service interaction, and service context. Third, the interviews were analyzed using an iterative approach of open coding and constant comparison to identify users' motivations for these preferences. Lastly, the survey data were used to assess the variation in background characteristics of the participants.

3.4 Findings

The generative tools (i.e., FaceMaker, timeline mappings) and the explorative interviews enabled users to express their preferences and motivations for these preferences. The coding of the interviews resulted in four categories of tacit and implicit needs that users have regarding VSAs' facial appearance, verbal- and nonverbal behaviors. First, an overview will be provided of users' preferences for facial appearance, verbal and nonverbal behaviors. Second, the needs underlying these preferences will be discussed. Finally, we will devote some attention to patterns and differences between service contexts that were observed.

3.4.1 User preferences for the facial appearance

For both service contexts, the facial parameters were averaged to construct an average face, see Figure 2. All 37 parameters were standardized and could thus vary between 0 and 1. Mean comparison of the facial parameters revealed that the average facial appearance in both service contexts was very similar. Based on

the average parameters for both faces in the category general, both faces can be described as more feminine than masculine, human-like, and having brown hair, medium skin tone, and some facial details. Furthermore, looking at the average parameters in the other categories, it is noteworthy that in both service contexts users preferred brown eyes. Mean differences between the two service contexts were all 0.20 or lower and can therefore be described as subtle. 'Face gender', 'hair color' and the 'forehead height' differed the most, with the average GP assistant (right) having a slightly more masculine facial appearance, a slightly darker hair color, and a lower forehead than the average virtual tax advisor assistant (middle).

Figure 2 Displays of the baseline face (left), the average face for the virtual tax advisor (middle), and the average face for the GP assistant (right)

Despite the strong overlap in the parameters of the average faces, we still observed individual differences in preferences within the two service contexts. These differences became apparent when we visually compared the individual faces to the average face for each of the two service contexts (see Figures 3a and 3b). Furthermore, for each service context, the standard deviation was calculated for all parameters as a measure of variety.

Figure 3a A comparison between the average face and the individual faces for the virtual tax advisor

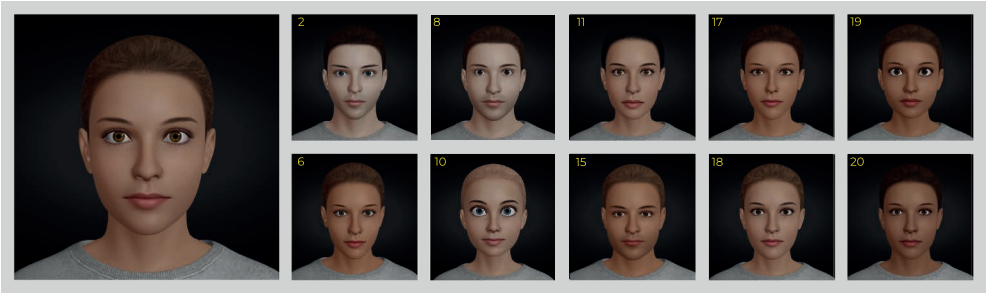
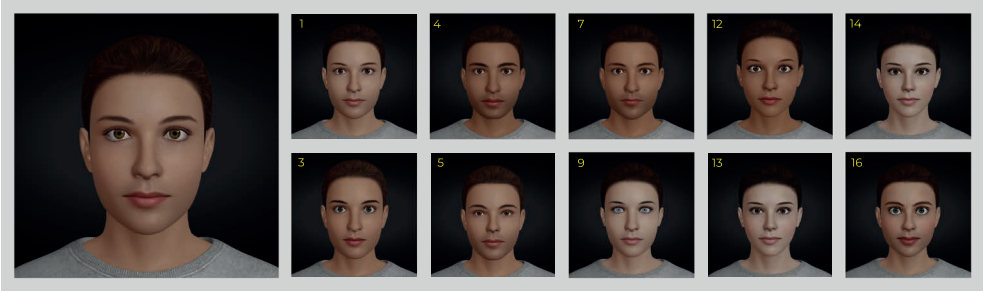


Figure 3b A comparison between the average face and the individual faces for the virtual GP assistant



Looking at these figures, subtle individual differences in facial preferences become apparent. For the virtual tax advisor, who is displayed in Figure 3a, participants seemed to vary on their preference for face gender, with some faces (2, 8, and 9) being more masculine than the average. Furthermore, most of the participants who preferred a more masculine face also preferred a very smooth and slightly lighter skin than the participants who preferred a feminine face (2 and 8). Lastly, one participant (10) preferred a face that differed markedly on many parameters including 'hair color' and 'cartoon-like appearance'. These visual observations were validated by the standard deviations, which showed that the parameters for 'face gender', 'hair color', 'skin details', 'eye color', and 'skin tone' varied the most. For the virtual GP assistant, who is displayed in Figure 3b, more parameters seemed to vary between individual participants. Besides hair color, most faces slightly varied on parameters such as 'eye color', 'face gender', and 'skin tone'. This observation was validated by the standard deviations, which were higher for most parameters in the GP condition, compared to the tax advisor condition.

3.4.2 Motivations for facial preferences

Guided by the codes that emerged from the interviews and the generated faces, we identified four categories of needs that users have regarding the appearance of VSAs: 1) warmth, 2) competence, 3) conformity to social norms, and 4) identification.

Warmth (social cognition)

In both conditions, participants expressed a strong need for appearance characteristics from which they infer warmth. Warmth is one of the two universal dimensions of social cognition (Fiske et al., 2007). For human survival, it is essential to immediately determine whether another social agent has good or bad intentions (i.e., warmth). Therefore, humans spontaneously interpret appearance characteristics and behaviors of interaction partners on the dimension of warmth. This dimension is inferred from appearance characteristics *that 'are related to perceived intent, including friendliness, helpfulness, sincerity, trustworthiness, and morality'* (Fiske et al., 2007, p.77). The finding that social cognition does not limit itself to animate agents confirms predictions in earlier research (van Doorn, 2017). Participants expressed a need for appearance characteristics that they associate with warmth to determine whether the virtual agent has good intentions. For example:

> *'That also has to do with that sweet appearance again. That I think: 'oh yes! You are someone I can turn to with my problems'. And of course, you know, if you're with a GP assistant, you can voice your complaints and be like: 'this and this is what's going on with me'. But it does help if that person also looks kind and sweet.'*
>
> (Participant 3 about the virtual GP assistant)

It is noteworthy is that in both conditions, participants inferred warmth predominantly from the agent's appearance. Therefore, in both conditions, the need for warmth seemed more prevalent when designing the appearance of the VSA. Furthermore, participants in both conditions indicated that they inferred warmth from the VSA's dark-colored hair, slightly darker skin tone, and dark-colored eyes. One participant explained:

> *'I often find brown eyes ... I find blue eyes much more beautiful, but I often find brown eyes just very ... it gives me a feeling of trust. So that's why I went for brown eyes.'*
>
> (Participant 20)

Although previous research has shown that perceptions of warmth in VSAs may trigger feelings of uncanniness (S.Y. Kim et al., 2019), only one participant (participant 9) explicitly acknowledged this effect.

From a service perspective, service employees that are perceived as warm are generally evaluated more positively, yet, several authors have hypothesized that the relative importance of warmth depends on the service context (Güntürkün et al., 2020; van Doorn, 2017). This study strengthens this expectation by showing subtle differences in the importance of warmth across both conditions. Overall, the need for warmth in the appearance of the VSA was more pronounced in the GP assistant condition. However, most participants stated that this was due to different social norms in the two service contexts, therefore, these differences will be discussed in more detail under 'conformity to social norms'.

Competence (social cognition)

In addition to warmth, participants expressed a need for appearance characteristics from which they infer competence. Competence is the second universal dimension of social cognition (Fiske et al., 2007). Besides determining whether another social agent has good or bad intentions (i.e., warmth), it is also important for humans to determine whether the agent can act on those intentions (i.e., competence). Therefore, humans also utilize the appearance characteristics and behaviors of interaction partners to estimate competence. This dimension is inferred from appearance characteristics that *'are related to perceived ability, including intelligence, skill, creativity, and efficacy'* (Fiske et al., 2007, p.77).

For most participants, the need for warmth seemed more prevalent when designing the appearance of the VSA than the need for competence. In addition, some participants indicated that they inferred competence from the VSA's verbal and nonverbal behavior, rather than from the VSA's appearance. One participant explained:

> *'I might be able to estimate that (referring to competence) in a real person, or I might get some sort of impression of that. But because I know it's not a real face ... the design of the face and the competence of the program are two separate elements created by two different groups.'*
>
> (Participant 6)

Yet, some participants did express a need for appearance characteristics from which they infer competence and in particular the agent's experience to deliver the service. Therefore, the dimension of competence also seems to play a role in the social perception of the appearance of conversational agents. The appearance characteristics mentioned were mainly VSA's age and clothing, which were not included as parameters in FaceMaker. For example:

> *'I think that age could also signal more experience, which I might find important for the tax advisor.'*
>
> (Participant 15 on the tax advisor)

Conformity to social norms

The previous two categories show that users need appearance characteristics in the VSA from which they can infer warmth and competence. However, the importance of these needs turned out to be highly dependent on the users' ideas about what is considered normal in society or what should be normal in society. Therefore, the category '*social norms'* was distinguished, which refers to the users' need to conform to social norms. This resonates with the idea that users '*have and display identifiable and relatively stable patterns of preferences regarding their relationships with service firms and employees'* (van Doorn et al., 2017, p.49).

First, participants voiced a need for appearance characteristics that they consider to be normal or even stereotypical for one of the two service contexts. For example, one participant explained the following about the virtual GP assistant:

> *'I wanted some kind of really sweet person or something. Where you can talk about your problem, even if it's just a broken arm. That you think, I feel safe here.'*
>
> (Participant 3)

While another participant said the following about the virtual tax advisor:

> *'Because it is a tax advisor. In one way or another, you automatically think of images of...at least me... yes of a bit of a plain Jane ... kind of a drowsy office worker in a gray suit.'* (Participant 4)

This is in line with research on stereotyping, which suggests that warmth is more important in hedonic service contexts, whereas competence is more important in utilitarian service contexts (Güntürkün et al., 2020). Many participants expressed the need to comply with such stereotypes.

In addition to stereotypes, participants also commonly stated that their preferences were driven by a desire to adhere to social or personal norms about, for example, gender roles, attractiveness, or clothing. Yet, as these norms are subject to change and highly dependent on someone's social circles, this was also a major cause of individual variation (Block et al., 2019). For instance, in the GP assistant condition, many participants indicated that they preferred a more feminine face as this was in line with the stereotypical image they had of a GP assistant. Yet, one participant indicated that this stereotypical image sharply contrasted with her personal views on gender equality in healthcare and that she, therefore, preferred a more masculine facial appearance:

> *'I just kind of object to it being women all the time. That might be very feminist, but then you always get stuck in a certain thing. Yes, women always care and then I just like it when it's not. For example, I have a [male] friend who works in healthcare and then I think: gosh that's nice. So, I'd like that same effect, because you don't see it that often. And if you are a little involved with that, then that is a kind of an extra plus.'*
>
> (Participant 4)

Identification

Lastly, the coded interviews revealed a strong need for identification. This category includes needs for appearance characteristics that the user can identify with. Two different types of identification were distinguished; identification with the self and identification with others. First, virtually all participants (with exception of participant 9) chose to create a human-like VSA, because they could identify

with such an appearance. More specific parameters, such as face gender or eye color were also chosen because the participant strongly identified with these parameters. For example:

> *'Why? Yeah, no idea really, maybe because I'm a man myself. No idea, it might as well have been a woman, I didn't think too much about it.'*
>
> (Participant 5)

Participants often indicated that identification made them feel comfortable and the VSA more likable. This finding is in line with similarity-attraction theory from social psychology, which stipulates that salient similarity in appearance characteristics between conversation partners leads to mutual attraction (Arndt et al., 2016; Montoya et al., 2008).

Yet, what is particularly interesting, is that some participants expressed a need for identification with others from their social circle, rather than identification with themselves. Usually, this was either because this person was associated in some way with the service context or, according to the participant, had traits that were desirable in the service context:

> *'My girlfriend is very caring, so that's exactly what I'm thinking about here, because it's also about a GP.'*
>
> (Participant 13)

3.4.3 User preferences for verbal behaviors

In order to analyze participants' preferences for the VSA's verbal behaviors, the frequencies of the chosen verbal expression cards in the participants' timeline mappings were analyzed. For each turn of the interaction, participants could choose between three verbal expressions from a verbal expression card or, alternatively, come up with an expression of their own. For every turn, the three pre-determined expressions were either (1) non-social, (2) slightly social, or (3) very social (Chattaraman et al., 2019; van Dolen et al., 2007).

Figures 4a and 4b display the frequencies (in percentages) with which the pre-determined expressions were chosen during every turn in the service interaction.

Figure 4a Frequencies of the preferred verbal expressions per turn for the virtual tax advisor, the darkest bar represents the mode for every turn.

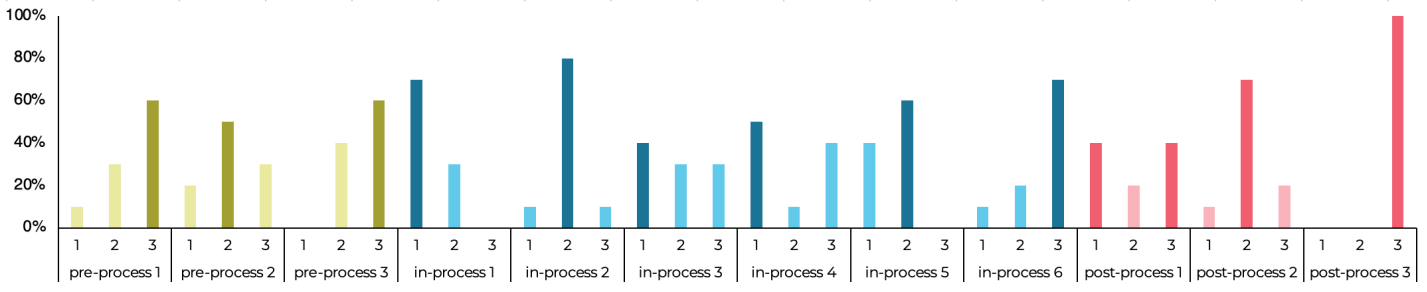
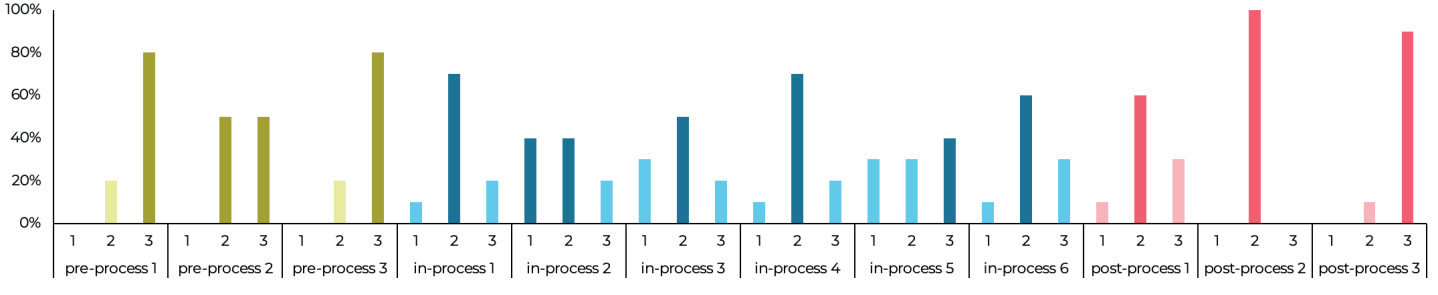


Figure 4b Frequencies of the preferred verbal expressions per turn for the virtual GP assistant, the darkest bar represents the mode for every turn.



Regardless of the service context, the majority of the participants preferred expressions that were slightly social to very social in the pre-process and post-process phases of the interaction. In the in-process phase, we observed more variation; not just between individual participants, but also between the two service contexts. During this phase, the majority of the participants preferred non-social to slightly social behavior from the virtual tax advisor, but slightly social behavior from the virtual GP assistant. However, for the turn in which the agents give advice (in-process 5 for the GP assistant and in-process 6 for the tax advisor), the majority preferred a very social expression.

3.4.4 User preferences for nonverbal behaviors

In order to analyze participants' preferences regarding the VSA's nonverbal behaviors, the frequencies of the chosen verbal expression cards in the participants' timeline mappings were analyzed. For each turn, the participants could add generative cards with descriptions of nonverbal behaviors such as nodding. In Figures 5a and 5b, the percentage of participants that chose a nonverbal expression card is displayed per turn. Furthermore, the most frequently chosen nonverbal behavior(s) per turn is displayed on the horizontal axis.

What is immediately noticeable, is that participants added nonverbal behaviors to the interaction more often in the GP assistant condition than in the tax advisor condition. This difference manifested itself mainly during the in-process phase. Also, the nature of the nonverbal behaviors differed between the two conditions. For the virtual tax advisor participants preferred nonverbal behaviors that indicated listening, such as nodding or leaning forwards. Yet, for the virtual GP assistant participants preferred behaviors that convey empathy, such as the display of sad or happy emotions. Furthermore, it is noteworthy that for both the virtual tax advisor and the virtual GP assistant, participants preferred nonverbal behaviors that indicate listening when the participant said something personal or subjective. This preference was mainly expressed during the in-process phase. For example, in the healthcare scenario participants preferred such behaviors when they were describing pain or symptoms. In the financial scenario, these preferences were often mentioned at turns in which participants had to give their date of birth or had to indicate whether they had a tax partner or not.

Figure 5a Preferences for nonverbal behaviors per turn for the virtual tax advisor

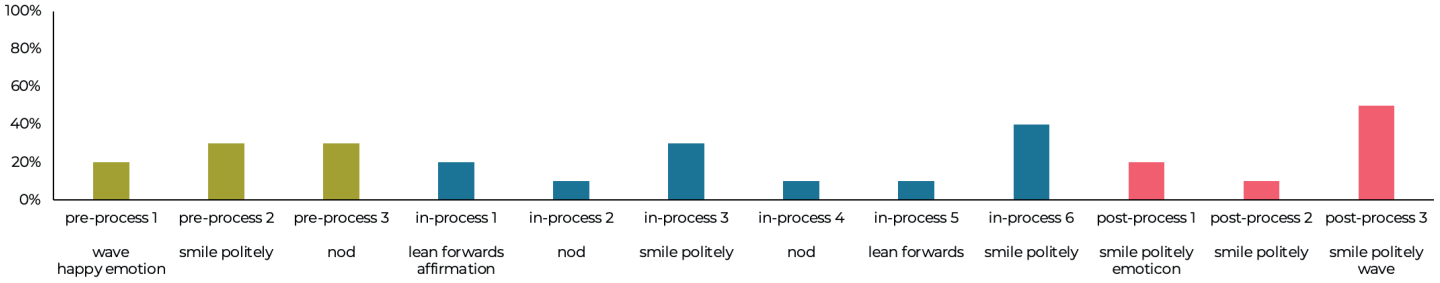
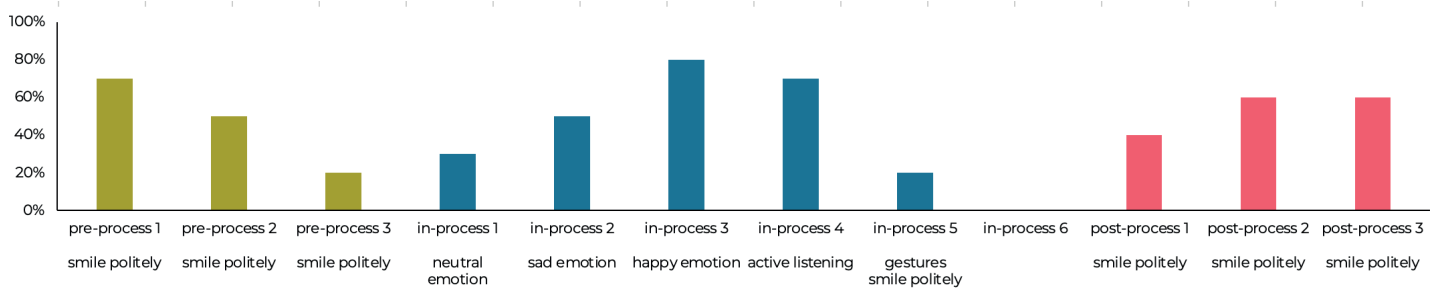


Figure 5b Preferences for nonverbal behaviors per turn for the virtual GP assistant



3.4.5 Motivations for these preferences

Guided by the codes that emerged from the interviews and supported by the storyline mappings, we identified five needs users have regarding the verbal and nonverbal behaviors of VSAs: 1) warmth, 2) competence, 3) validation, 4) user experience, and 5) convenience.

Warmth (social cognition)

As described under appearance, the results showed that users not only infer perceptions of warmth from the VSA's appearance characteristics but also from its verbal and nonverbal behaviors. Similar to appearance characteristics, this concerns verbal and nonverbal behaviors that *'are related to perceived intent, including friendliness, helpfulness, sincerity, trustworthiness, and morality'* (Fiske et al., 2007, p.77). Participants indicated they needed these behaviors to determine whether the intentions of the VSA were good. Although participants mainly inferred perceptions of warmth from the appearance of the VSA, they expressed the need for some verbal and nonverbal behaviors as well. Specifically, in both conditions participants inferred perceptions of warmth from social-oriented verbal expressions, polite smiles, and expressions of emotions. VSAs that utilize more social expressions were perceived as warmer and friendlier. Similarly, VSAs that smiled politely and showed emotions were perceived as more empathic and caring. However, this need for warmth in the agent's verbal and nonverbal behaviors seemed to be particularly salient during the pre-and post-process phases for both conditions. Therefore, warmth seems crucial for winning over users' trust at the beginning and the end of the interaction. As one participant explained:

> *'Yes, I think you should have it in the beginning, fairly upfront. Yes. To give people a little bit of that... kind of confidential feeling or something... especially at the beginning of the in-process phase.'*
>
> (Participant 2)

Competence (social cognition)

In contrast to warmth, users' need for competence is more pronounced in their preference for verbal behaviors than for appearance characteristics. As such, the category competence includes the need for verbal and nonverbal behaviors that

'*are related to perceived ability, including intelligence, skill, creativity, and efficacy*' (Fiske et al., 2007, p.77). Specifically, participants indicated that they inferred this from the quality of the information in the verbal expressions and less so from nonverbal behaviors. In both conditions, competence in verbal and nonverbal behaviors was considered a basic requirement by many participants to carry on with the interaction. Participants indicated that they would abandon the service if the VSA asked for the same information twice or misinterpreted their questions. Furthermore, some participants explicitly stated they were less forgiving towards the VSA in this respect than towards a human service agent. For example, one participant explained:

> *'Yes, look, here I would already be very ... I would already find this irritating. In my previous answer I said 'yes, it was for my work', so now they are going to ask 'was it for your work?' That's the whole... You just notice that you're talking to a robot', and I find that annoying.'*
>
> (Participant 2)

Validation

Both the timeline mappings and the interviews revealed participants' need for validation as a third category. Validation constitutes verbal and nonverbal behaviors from the VSA that recognize or affirm that the input from the user is valid or worthwhile, such as nodding. As such, validation is a specific form of responsiveness as defined in chapter 2 (Hoffman et al., 2014). In both conditions, participants often indicated a preference for both verbal (e.g., repeating information) and nonverbal behaviors (e.g., nodding) that indicate listening and understanding. However, participants were very particular about the timing of these behaviors. In both conditions, participants voiced a high need for these behaviors when the participant discussed information in the previous turn that could be classified as subjective or personal. For example, one participant stated:

> *'Maybe a nod or something like that, being listened to, that would be a good fit. For the same reason really...that I'm describing something and I'm describing symptoms that are not quantitative... and that there is some kind of understanding for it.'*
>
> (Participant 1)

The need for validation was particularly salient in the GP assistant condition, which resonates with the use of nonverbal behaviors displayed in Figures 5a and 5b. In the GP assistant condition, participants added nonverbal behaviors more often. In addition, during the pre-processing phase, many participants in both conditions mentioned that they preferred the VSA to repeat some personal information, just to show that the technology works as it is supposed to work.

Pleasant user experience

Fourth, the results showed a strong need for a pleasant user experience. This entails that the users valued having an enjoyable interaction with the VSA. This closely resembles the 'enjoyable interaction' dimension of rapport by Gremler and Gwinner (2000, p.12) that is defined as '*an affect-laden, cognitive evaluation of one's exchange with a contact employee'*. Various participants from both conditions mentioned that in order to have an enjoyable interaction, it was important for the VSA to maintain 'conversational flow'. Conversational flow entails that the VSA should involve users in the interaction to the extent that they enter a state of flow, which is a mental state of high enjoyment that motivates the user to continue using the service (Nakamura & Csikszentmihalyi, 2014; Zhou, 2020). Some participants suggested the VSA could achieve this by incorporating linking words that signal the structure of the conversation such as 'first', 'now' or 'lastly', as this participant indicated:

> *'I like that 'finally', that you know you're almost at the end.'*
>
> (Participant 5)

In addition, participants indicated that the VSA should not fluctuate too much in the degree of socialness of both verbal and nonverbal behaviors in consecutive turns. Rather, they preferred subtle differences and a certain degree of consistency. For the verbal behaviors of VSAs, this resonates with figures 4a and 4b, in which can be seen that the modes of the verbal expressions for two consecutive turns are rarely opposites of each other. This illustrates that if a participant chooses a very social expression during a specific turn, it is unlikely that the participant will choose the non-social expression in the subsequent turn. For the nonverbal behaviors of the VSA, consistency was also mentioned as important, yet this was not expressed by choosing similar nonverbal behaviors in two consecutive turns. Rather, participants indicated that when they needed validation the VSA should use them consistently or not at all.

Convenience

Previous needs all resonate with the literature on human-to-human service interactions, yet, one of the defined needs is characteristic for VSAs. Various participants in both conditions indicated that compared to an interaction with a human service employee, they expected more convenience in an interaction with a VSA. Convenience here entails all verbal and nonverbal behaviors from the VSA that minimize the cognitive effort needed to use the service. This resonates with the Technology Acceptance Model (Gefen et al., 2003) that has demonstrated that the perceived ease of use of a technology drives users' intention to use the technology again. A participant explained:

> *'I think she's a bit cold, but I also think that's appropriate or something, yes, it doesn't have to, it is, it's just all very direct on such a website, it doesn't lead to a nice conversation, so it's just tight, clear, clear and that's it, that's exactly what you need it for.'*
>
> (Participant 7)

Specifically, this entailed that they preferred the VSA to be concise and omit unnecessary small talk. Figures 4a and 4b reflect this need by showing that in both conditions there was a strong preference for non-social to slightly social expressions during the in-process phase. One participant expressed:

> *Because I notice here that I ... yes, here I will eventually get my answer, so I want results as quickly as possible and then I don't feel like long conversations.'*
>
> (Participant 11 on the in-process phase)

Regarding the preferences for nonverbal behaviors in the VSA, participants in both conditions expressed that these behaviors should be functional. This functionality entails that if nonverbal behaviors are included in the in-process phase, they should enrich the verbal expression (e.g., by pointing at something or making certain gestures).

3.5 Discussion

In this study, we used a generative design approach (Sanders & Stappers, 2014) to gain more insight into the communicative needs and preferences of potential users of virtual service agents (VSAs). By providing them with a variety of generative tools,

we enabled participants to use their creativity in designing their ideal interaction with a VSA. Participants were able to determine for themselves what the face of the VSA looked like and which verbal and nonverbal behaviors it displayed in different phases of the service interaction. To uncover the needs underlying their design choices, we asked the participants in semi-structured interviews about the motivations behind their preferences.

Previous research on the use of human-like communicative behavior by VSAs had already shown that their effects are moderated by user characteristics and preferences (Chattaraman et al., 2019; Derrick & Ligon, 2014; Krämer et al., 2018), but to the best of our knowledge, a systematic inventory of users' needs had not yet been conducted. Furthermore, communicative behaviors were often investigated in isolation, so that insight into the joint effects of appearance, verbal behavior, and nonverbal behavior was lacking. In our study, we aimed to paint a more complete picture by (1) having users design all aspects of the VSA's appearance and communicative behavior, (2) interviewing users about these aspects but also about the interaction between these aspects, (3) making an explicit distinction between the different phases of the service interaction, and (4) conducting the study for two different service contexts: one hedonic-dominant context (a conversation with a virtual GP assistant) and one utilitarian-dominant context (a conversation with a virtual tax advisor).

The participants' design choices and responses reveal some interesting patterns. Concerning the facial features of the VSA, participants express a strong need for warmth, conformity to social norms, and identification. In our study, the need for warmth manifests itself in a widely supported preference for dark-colored hair, but sometimes also in dark-colored eyes or feminine face characteristics. The service context turned out to have a limited impact in this case, as could be seen in the similarity of the average faces per condition. The individual differences between participants mainly seemed to stem from differences in personal and social norms and identification.

With regard to the VSA's verbal and nonverbal behaviors, participants expressed the need for warmth, competence, validation, convenience, and pleasant user experience. Due to the need for warmth, they often chose social expressions, especially in the initial and final phases of the interaction. The need for competence was considered a basic requirement by participants which could be fulfilled by

informative answers from the VSA. The need for validation was particularly salient during the in-process phase and characterized by a preference for nonverbal behaviors that indicate listening. The service context also seemed to influence this last need: in the GP assistant condition, participants chose nonverbal behaviors far more often than in the tax advisor condition.

3.5.1 Theoretical implications

The theoretical contribution of this study lies mainly in the overview of communicative needs that has been generated. Previous studies have identified variables that moderate the effects of human-like communicative behaviors used by VSAs (e.g., gender or extraversion), but have not always been able to explain why certain behaviors work in some situations but not in others. The contribution of this overview of needs is threefold.

First, the presented overview enables researchers to find explanations for earlier findings, that were difficult to explain. For example, the taxonomy presented in Chapter 2 has shown that verbal communicative behaviors grounded in responsiveness produced predominantly mixed effects. A potential explanation for this is offered by this study that has shown that users' need for validation fluctuates due to the service context, the phases of the service interaction, and individual characteristics. Therefore, these changing needs might explain why studies investigating the effects of these behaviors have yielded mixed results.

Second, the presented overview allows researchers to identify additional human-like communicative behaviors that could be implemented in VSAs to meet a particular need. Chapter 2 presented some overlooked behaviors that enhance relational outcomes in human-to-human service interactions but have not been validated in human-to-machine interactions. Examples included verbal expressions that signal cognitive processes (e.g., 'let me think'), verbal expressions of empathy, and the attire of the VSA. As the first two verbal behaviors could help to meet users' need for validation and the latter users' need for identification and adherence to social norms, they form promising avenues for future research. However, it should be noted here that researchers should also take into account the service context and the phases in the service interaction, as this study has shown that these needs are not static or universal for all service contexts

Third, this study has validated warmth and competence as important users' needs regarding conversational agents (Bergmann et al., 2012; S.Y. Kim et al., 2019; Van Doorn et al., 2019). Yet, an earlier study by Seo Young Kim et al. (2019) indicates that increasing the human likeness of conversational agents would increase warmth but decrease liking. This study found no support for this finding. Quite the contrary, the users expressed to like warmth in both the appearance and the verbal and nonverbal behaviors of the VSA. We recommend future research to further look into the relationship between warmth and competence and relational outcomes. Furthermore, this study also goes beyond warmth and competence by identifying additional important users' needs for both appearance characteristics and verbal and nonverbal behaviors. Therefore, researchers should not focus entirely on those two concepts, but should also look further into other needs.

3.5.2 Practical implications

Interaction designers can use the results of this study to adapt the communicative behavior of VSAs to the needs of their users. The results clearly show that some preferences are widely shared and therefore do not need to be adapted to individual users or the service context. Examples are hair color and eye color. On the other hand, some preferences are strongly linked to the phase of the interaction (e.g., social expressions), the service context (e.g., nonverbal behaviors that indicate validation), or idiosyncratic needs of individual users (e.g., face gender). To determine which settings or parameters work best for the specific target group for which the VSA is being developed, designers can use the methodology described in the current study.

3.5.3 Limitations

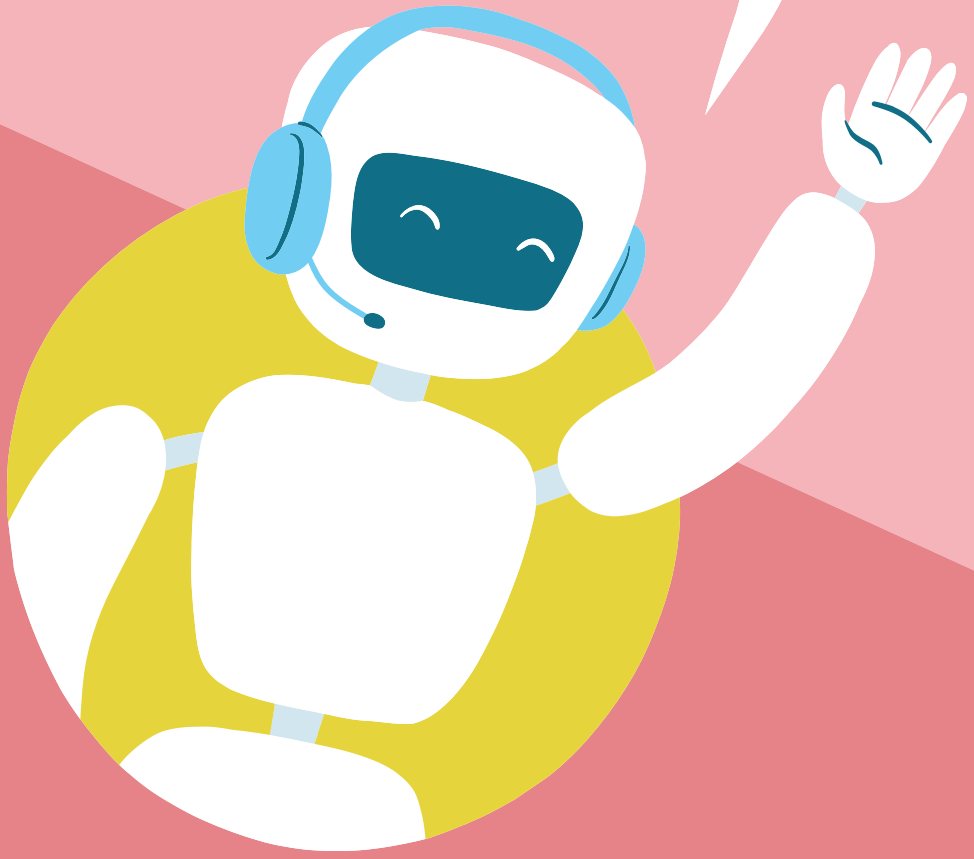
Of course, the current study also has limitations. As is common in qualitative research, the number of participants was relatively small. For the verbal and nonverbal behaviors, saturation was achieved, both for the preferences and the underlying motivations. For the facial features, on the other hand, it might have been possible to gain more insight into the parameters on which they differed if more people had participated in this study. To be able to quantify the variety observed in participants' design choices, it may therefore be advisable to repeat that part of the study with more participants.

Second, the generative tools that were provided to the participants may have limited the participants' creativity. Although the participants were explicitly encouraged to consider additional and alternative design choices, it cannot be ruled out that their preferences would have turned out differently if they had been provided with other tools and default options. Therefore, providing participants with a broader set of design choices is something that could be investigated in a follow-up study.

A similar point can be made for the two service contexts this study focused on. Although they differ in their degree of hedonism, they both deal with important topics in the daily lives of participants: health and money. A service context with less impact (e.g., an interaction with an online retailer about a low-priced item that was ordered) might have resulted in different preferences and different underlying needs. That is why it is important to investigate more different service contexts in follow-up research.

Finally, the results are probably also influenced by the cultural background of the participants. If this study had not been carried out in the Netherlands, but for example in Japan or Brazil, the VSAs would likely have looked and behaved differently, both verbally and nonverbally. Whether the underlying needs would also differ, however, is an empirical question that can only be answered by replicating this study in other cultures.

CHAPTER 4
THE EFFECTS OF COMMUNICATION STYLE ON RELATIONAL OUTCOMES IN INTERACTIONS BETWEEN CUSTOMERS AND CONVERSATIONAL AGENTS



4.1 Introduction

In recent years, conversational agents (chatbots, avatars, and robots) are increasingly used in service environments to augment or replace human service employees (Ling et al., 2021). Examples include educational chatbots (Smutny & Schreiberova, 2020), hotel receptionist avatars (Y. Choi et al., 2020), and socially assistive elderly care robots (Čaić et al., 2018). Conversational agents distinguish themselves from other automation technologies through their ability to mimic human-to-human conversation, using human-like appearance characteristics (e.g., facial features, embodiment), verbal behaviors (e.g., humor, social praise), and nonverbal behaviors (e.g., nodding, facial expressions) (Ling et al., 2021; Seeger et al., 2017). Because of this ability, conversational agents are often perceived as social actors who '*can create social and emotional connections with their human partners*' (Cabibihan et al., 2014, p.311). Therefore, conversational agents offer service providers the opportunity to automate part of the service delivery process, without losing the social connection between the service employee and the customer[3]. This connection is important, as a strong social connection between the service employee and the customer has been found to enhance relational outcomes, such as the intention to use the service again (Belanche et al., 2021; Huang & Rust, 2021).

In reality, however, incorporating human-like communicative behaviors (HCBs) in conversational agents is not always sufficient to create a social connection with the customer (Seeger et al., 2021). Chapter 2 has revealed that the effects of a human-like appearance are predominantly positive, but that the use of verbal behavior that signals responsiveness (e.g., showing empathy or expressing social praise) has mixed effects. In some of these studies, it is suggested that these mixed effects are due to variation in customers' needs (Bickmore & Cassell, 2005; Derrick & Ligon, 2014). Other studies also show that a higher degree of human-likeness in communication does not always lead to more positive relational outcomes (Clark et al., 2019; Stein & Ohler, 2017). Therefore, based on the existing literature, it is difficult to draw clear conclusions on the effectiveness of the use of verbal behaviors that signal responsiveness by conversational agents.

The current study aims to address this gap, by focusing on the communication style used by the conversational agent. Communication style is defined by Williams

[3] As the study presented in this chapter was conducted in a commercial setting, the term 'customer' is used here instead of 'user'.

and Spiro, (1985, p.21) as '*the synthesis of content, code, and communication rules into unique and infinite combinations*'. As such, communication style is a rather broad construct, which comprises of multiple dimensions. One dimension that has received considerable attention in the service literature is the distinction between a task-oriented and a social-oriented communication style (Lin & Lin, 2017; van Dolen et al., 2007). Whereas task-oriented communication focuses on the successful completion of a task at minimal effort, social-oriented communication is aimed at fulfilling the emotional needs of the other party and enhancing closeness, e.g., by expressing praise or showing interest (van Dolen et al., 2007; Williams & Spiro, 1985). In the service marketing literature, it has been recognized that a social-oriented communication style used by a service employee can foster a social connection with the customer as it signals responsiveness (I. Kim et al., 2011; van Dolen et al., 2007; Webster & Sundaram, 2009). Therefore, several scholars have suggested that conversational agents would also benefit from utilizing utterances like '*it's lovely to have you here'* or '*I am happy to help*' (Araujo, 2018; Chattaraman et al., 2019; Li & Mao, 2015; Veletsianos, 2012).

However, research into the effects of a social-oriented communication style when used by conversational agents has yielded mixed results (V.N. Lu et al., 2020). First, while some studies suggest that customers' needs moderate the effects of verbal behaviors indicating responsiveness (Chattaraman et al., 2019; Li & Mao, 2015), these needs are not explicitly incorporated in the design of these studies. Second, although it is quite unnatural for human interlocutors to utilize the same communication style throughout the entire interaction (Gustafson & Bell, 2000; Yoo et al., 2015), most current research on conversational agents operationalizes communication style in exactly this way (i.e., always task-oriented or always social-oriented). Lastly, most studies thus far have a strong focus on specific customer groups, such as the elderly (Chattaraman et al., 2019), youth (de Cicco et al., 2020), or students (Veletsianos, 2012). As a result, scholars have limited theoretical understanding of impact that customers' needs have on the relationship between the communication style a conversational agent utilizes and its effects on the perceived rapport.

This study aims to overcome these limitations by investigating the effects of the use of an adaptive social-oriented communication style in addition to a static task-oriented and a static social-oriented communication style. An adaptive social-oriented communication style entails that the conversational agent

mimics the communication style that the customer used in the previous turn. According Communication Accommodation Theory (Giles, 2016), accommodating to the communication style of an interlocutor signals responsiveness to the communicative needs of that interlocutor. In addition, an adaptive communication style increases the naturalness and the flow of the interaction. Therefore, this study aims to 1) research whether the use of a social-oriented communication style (versus a task-oriented style) by a conversational agent enhances the social connection as perceived by the customer and 2) if so, whether it is more effective to implement such a social-oriented communication style statically or adaptively.

4.2 Literature review

4.2.1 Effects of communicative behaviors in service interactions with human service employees

In the literature on human-to-human service encounters, the communicative behaviors of the service employee have been widely recognized to contribute to the overall success of the service encounter (Lin & Lin, 2017; Palmatier et al., 2006). Generally, service encounters comprise an interaction between the customer and the service employee, whose goal is to handle the service request. The service interaction is more than a chance to deliver quality core service; it also provides an opportunity to establish a strong service relationship with the customer (R.M. Morgan & Hunt, 1994). During the service interaction, the customer infers perceptions of the service employee (e.g., competence, friendliness) from their appearance, their verbal and their nonverbal communicative behaviors (Specht et al., 2007; Sundaram & Webster, 2000). These perceptions affect relational mediators, including the perceived social connection with the service employee, which in turn influence important relational outcomes, such as the intention to use the service again (Gremler & Gwinner, 2000; Palmatier et al., 2006).

4.2.2 Social vs. task-oriented communication

In human-to-human service interactions, a service employee can adopt a communication style that is more task- or more social-oriented (Sheth, 1976). A task-oriented communication style is aimed at the successful and efficient completion of a task at minimal effort, cost, and time and constitutes behaviors that set goals, clarify and inform (van Dolen et al., 2007; Williams & Spiro, 1985). A

social-oriented communication style adds a layer to the conversation that does not come at the expense of its efficiency (Seeger et al., 2017). A social-oriented communication style is aimed at fostering relationships, is personal and social, and constitutes communicative behaviors that personalize, fulfill emotional needs, and enhance closeness (van Dolen et al., 2007; Williams & Spiro, 1985). For example, van Dolen et al. (2007) operationalize a social-oriented communication style by utilizing informal expressions, such as 'I think that is a great idea!' and 'I understand what you mean'. Similarly, Chattaraman et al. (2019) use simple expressions to render the social-oriented condition more conversational and informal, like 'how good to have you here!' and 'I've enjoyed assisting you today'. Therefore, a social-oriented communication style involves informal, social dialog including personalized greetings and closings, emotional support, human-relationship-related talk, and small talk (Yoo et al., 2015). The use of a social-oriented communication style during service interactions has been found to enhance the perceived social connection with the customer and hence relational outcomes (I. Kim et al., 2011; van Dolen et al., 2007; Webster & Sundaram, 2009). Therefore, human service employees are often advised by service managers and designers to incorporate elements of a social-oriented communication style in their service interactions (Lloyd & Luk, 2011).

4.2.3 Effects of communicative behaviors in service interactions with conversational agents

As stated in the introduction, more and more service providers are integrating conversational agents into their service delivery processes. Consequently, it should come as no surprise that there is a considerable body of literature that looks into the effects of human-like communicative behaviors when used by conversational agents (see chapter 2 for an overview). Many of these studies support the notion that the use of HCBs by conversational agents enhances positive perceptions customers have towards the agent and thereby relational outcomes (Araujo, 2018; Verhagen et al., 2014). An explanation for these effects comes from the Computers As Social Actors paradigm, which claims that humans tend to unconsciously apply knowledge for human social perception to computers (Nass et al., 1994). For example, Nass et al. (1995) have shown that humans perceive a computer using strong language as having a more dominant personality compared to a computer using more tentative language, which is in line with research on the perception of strong language among humans. This tendency is often ascribed to anthropomorphism, which refers to the attribution of human qualities, including

consciousness, intentions, and emotions, to nonhuman agents or objects (Epley et al., 2007). As knowledge on humans is highly accessible to humans, the presence of human-like characteristics or behaviors in non-human agents activates cognitive schemes for human interaction (Aggarwal & McGill, 2007).

The fact that people engage in anthropomorphism, and thus apply their knowledge for human social perception to conversational agents, offers opportunities for service providers and designers. Various empirical studies have shown that conversational agents can utilize the same myriad of communicative behaviors that human service employees use to establish relationships (Fink, 2012). For example, Torre et al. (2020) have shown that a chatbot with a happy tone of voice, also called a 'smiling voice' is trusted more than a chatbot with a neutral voice. Similarly, Soderlund et al. (2021) have found that a virtual service agent expressing happiness through positive words and exclamation marks is evaluated more positively than an agent that does not. The inclusion of HCBs in the design of conversational agents can thus increase customers' perceptions of the agent's social capabilities (Holtgraves et al., 2007). Moreover, because the customer attributes human characteristics and qualities to the conversational agent, the conversational agent becomes perceptually more similar to the customer (Eyssel et al., 2012). Therefore, various authors have demonstrated that the use of HCBs by conversational agents can enhance the customer's experienced social connection with the conversational agent (Cerekovic et al., 2017; Gratch et al., 2007; Moriuchi, 2021).

4.2.4 Perceived social connection with human and non-human service employees

In the literature on human-machine interaction, two different concepts are distinguished to operationalize the perceived social connection between a conversational agent and a customer. The first concept is the customer's engagement in the service interaction (Ivaldi et al., 2017; Ling et al., 2021; Moriuchi, 2021; Sidner et al., 2014) In the context of conversational agents, engagement is often defined as social engagement (Sanghvi et al., 2011), which is *'the value that a participant in an interaction attributes to the goal of being together with the other participant(s) and continuing the interaction'* (Poggi, 2013). As such, it describes the motivation of the customer to engage in a service interaction with the conversational agent (Oertel et al., 2020).

In addition to engagement, rapport is increasingly used to operationalize the perceived social connection with the agent (Cerekovic et al., 2017; Gratch et al., 2007; von der Pütten et al., 2010). Rapport is described by Tickle-Degnen and Rosenthal (1990, p.286) as an experience in which '*participants in the interaction form a cohesiveness, become unified, through the expression of mutual attention to and involvement with one another'*. Rapport is often described as 'clicking' or 'having chemistry together' (Seo et al., 2018). These descriptions reflect the notion that conversational agents can '*create social and emotional connections with their human partners*' (Cabibihan et al., 2014, p.311).

This study will define the perceived social connection as a combination of engagement and rapport for two reasons. First, as the literature on human-machine interaction is divided on the conceptualization of perceived social connection, including both concepts can reveal for both them to what extent and how they are affected by HCBs. Second, including both concepts resonates better with the service marketing literature. In this stream of literature, the social connection between a service employee and a customer is also referred to as rapport, albeit with a broader conceptualization (DeWitt et al., 2008; Gwinner et al., 1998). More specifically, marketing scholars conceptualize rapport as a two-dimensional construct consisting of the dimensions '*enjoyable interaction*' and '*personal connection*' (Gremler & Gwinner, 2000). A factor analysis by Von der Pütten et al. (2010) shows that measures of rapport from the literature on human-machine interaction do not cover the 'enjoyable interaction' dimension, possibly because its operationalization is difficult to apply in the context of conversational agents. On the other hand, the concept of engagement as defined above does show conceptual overlap with this dimension (Oertel et al., 2020). As the service marketing literature has shown that social-oriented communicative behaviors have positive effects on both dimensions of the broad conceptualization of rapport (Gremler & Gwinner, 2000; I. Kim et al., 2011), it provides support for our hypothesis that social-oriented communication will have positive effects on both engagement and rapport as defined in the human-machine interaction literature.

4.2.5 Conversational agents' communication style and perceived connection

Several authors have investigated the effects of the use of a social-oriented communication style by conversational agents, but these studies are highly

fragmented with regard to the variables and customer groups under investigation. Despite this fragmentation, they seem to find overall positive effects for different implementations of a social-oriented communication style on different relational outcomes. For example, Araujo (2018) manipulated the communication style of a chatbot to be more human-like by using subtle utterances such as '*hello*' or '*goodbye*'. Results showed that participants who interacted with the chatbot using a social-oriented communication style experienced a stronger emotional connection with the company. Similarly, Guo and Goh (2016) found that students in an online learning environment were more motivated and experienced more pleasure in completing a learning task when the virtual agent guiding them encouraged them (e.g., 'I am convinced that you can'). Furthermore, Strait et al. (2014) demonstrated that a robot helper was perceived as more considerate and less controlling when utilizing a polite, indirect communication style. In addition, in a study conducted by de Cicco et al. (2020) participants were asked to order food through an online chatbot which was manipulated to use either a task-oriented or a social-oriented communication style. Results showed that customers experienced higher levels of enjoyment with the social-oriented chatbot, which in turn increased their intention to interact with the chatbot again. This finding is important as enjoyment is closely related to engagement (Caroux et al., 2015). Lastly, Iwamura et al. (2011) have found that elderly shoppers enjoyed grocery shopping with a robot more when it utilized superfluous, social-oriented utterances ('*Cool, it sounds delicious*') compared to a shopping robot who did not utilize these utterances. Taken together, the above literature suggests that a social-oriented communication style may be more effective than task-oriented communication style in enhancing the perceived social connection with the customer. Therefore, we hypothesize the following, see Figure 1:

> **H1a:** Customers interacting with a conversational agent using a social-oriented communication style will experience stronger engagement compared to customers interacting with the agent using a task-oriented communication style
>
> **H2a:** Customers interacting with a conversational agent using a social-oriented communication style will experience stronger rapport with the agent, compared to customers interacting with the agent using a task-oriented communication style

4.2.6 The role of users' needs and conversational flow

In contrast to the studies discussed in the previous section, some scholars only found positive effects of a social-oriented communication style under very specific conditions. For example, Chattaraman et al. (2019) have researched the effects of a social-oriented communication style in a virtual assistant for elderly people. Their results demonstrate that a social-oriented communication style enhances perceptions of interactivity and trust in the integrity of the website, but only for elderly with a low need for task-related assistance. Similarly, Bickmore and Cassell (2005) have examined the use of small talk by a virtual agent in a social dialogue and found that it increased trust for extroverts but not for introverts. Finally, Li and Mao (2015) have shown that when customers perceive alignment between a virtual health advisor's communication style and their own communication style, they experience a higher degree of engagement and enjoyment.

In addition, there are some indications that a conversational agent using only one communication style during the service interaction appears unnatural to the customer. For example, a quasi-experimental study by Veletsianos (2012) demonstrated that limited use of social comments by a virtual agent increased the customers' perception of the agent's ability to interact with them, although not significantly. However, increasing the number of social comments further significantly reduced the customers' perception of the agent's ability to interact with them. This finding resonates with studies of human-to-human interactions, which suggest that it is unnatural to use a social-oriented communication style throughout the entire interaction (Williams & Spiro, 1985). According to a study by Gustafson and Bell (2000) on conversations with a virtual navigation assistant, one-third of the utterances from a corpus of 10,000+ customer utterances were social-oriented. Similarly, Yoo et al. (2015) analyzed a corpus of chat interactions between nurses and asthma patients and found that socio-emotional behaviors (positive expressions, emotional support, social conversation) were used 26 per cent of the turns by the nurse and 40 per cent of the turns by the patient, respectively.

Together, these findings suggest that a social-oriented communication style is only effective when; (1) it meets the communicative needs of the customer, and (2) it is applied with a natural frequency. Therefore, having the conversational agent mimic the communication style of the customer might be a more viable solution (Li & Mao, 2015). According to Communication Accommodation Theory, adapting

to what others do and say is a central feature of human social interaction and a way to understand and respond to others' needs (Bowen et al., 2017; K.A. Duffy & Chartrand, 2015; Giles, 2016). One important strategy to adapt to others' needs is mimicry (Dragojevic et al., 2016). Mimicry has been said to act as a 'social glue', affectively attuning interlocutors to each other, establishing engagement between them, and inducing feelings of social connectedness (Lakin & Chartrand, 2003). Therefore, Communication Accomodation Theory explains why in previous studies, mimicry of the customer's appearance (Dotsch & Wigboldus, 2008; Vugt et al., 2010), head movements (Bailenson & Yee, 2005) and expressions of personality (e.g., loudness, facial expression) (K.M. Lee et al., 2006b) were shown to be effective when utilized by conversational agents. Furthermore, an adaptive communication style increases the naturalness and the flow of the interaction. Hence, we hypothesize:

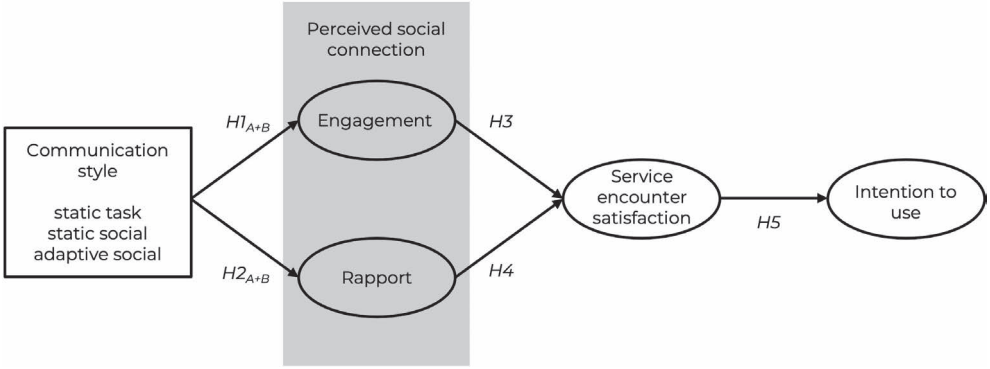
> **H1b:** Customers interacting with a conversational agent using an adaptive social-oriented communication style will experience stronger engagement compared to customers interacting with the agent using a static social-oriented communication style
>
> **H2b:** Customers interacting with a conversational agent using an adaptive social-oriented communication style will experience stronger rapport with the agent, compared to customers interacting with the agent using a static social-oriented communication style

4.2.7 Perceived social connection and relational outcomes

The social connection with the customer has been found to influence the customer's intention to use the service again via service encounter satisfaction. In the service marketing literature, rapport has been found to have positive effects on service encounter satisfaction (Macintosh, 2009; Rau et al., 2010), which in turn influences intention to use (Liao et al., 2017). In addition, there is growing evidence from the human-to-machine literature that both engagement and rapport (although conceptually different) positively influence customers' intention to use the service again (Moriuchi, 2021). Therefore, we hypothesize that:

> **H3:** Engagement has a positive effect on service encounter satisfaction
>
> **H4:** Rapport has a positive effect on service encounter satisfaction
>
> **H5:** Service encounter satisfaction has a positive effect on the intention to use the service again

Figure 1 Conceptual model and hypotheses



4.3 Methodology

To test the proposed hypotheses, an online experiment was conducted. Participants were asked to interact with a virtual travel agent called Charlotte, who was programmed to advise customers on potential holiday destinations, see Figure 2. The interaction was simulated using 'DialogueTrainer' (Jeuring et al., 2015) which is an online platform that allows customers to interact with avatars that can communicate through written text, facial movements, and facial expressions (e.g., a polite smile). The travel context was chosen because it has been classified as both hedonic and utilitarian in nature (Wani et al., 2017), which provides a more level playing field for a comparison between task-oriented and social-oriented communication style (cf. Keeling et al., 2010).

4.3.1 Participants

Volunteer sampling was used to recruit Dutch-speaking participants for the study. Among the participants, four restaurant vouchers were raffled as an incentive. A total of 147 respondents participated in the study, but missing values resulted in the exclusion of 5 respondents, leaving a final sample of 142 participants. The participants' age ranged from 17 to 62, with a mean age of 23 years (*SD* = 6.54). Regarding gender, 31 per cent of the participants identified as male, 63 per cent as female, 5 per cent as non-binary, and 1 per cent did not want to answer this question. 89 per cent of the participants indicated having interacted before with virtual service agents.

Figure 2 Charlotte the virtual travel agent

4.3.2 Procedure

Participants were told they were taking part in an online survey on the usability of a virtual travel agent. They were instructed to carefully read a scenario describing some preferences for an imaginary vacation to a destination yet to be determined. To get advice on destinations that would suit their preferences, participants were asked to interact with virtual travel agent Charlotte. To start the interaction, participants were instructed to select one out of two opening utterances that was the closest to the way they would start the conversation in real life. One of these utterances was task-oriented, whereas the other was social-oriented. After participants had selected the initial utterance, the virtual travel agent responded, using either a task-oriented or a social-oriented utterance, depending on the experimental condition (see below). This procedure was repeated nine times; after the tenth response by the service agent, the interaction was over.

4.3.3 Experimental materials

The task- and social-oriented utterances for both the participants as well as the conversational agent were based on examples provided by van Dolen et al. (2007) and Chattaraman et al. (2019), see table 1. All utterances were judged independently

by four communication experts, who classified all of them correctly as either task- or social-oriented.

4.3.4 Design

This experiment used a one-factor between-subjects experimental design. Participants were randomly divided over three conditions; 1) the static task-oriented condition (n = 44), 2) the static social-oriented condition (n = 50) or 3) the adaptive social-oriented condition (n = 48). Participants in the three conditions did not significantly differ in age (F = 2.31, p = 0.10) or affinity with technology (F = 1.14, p = 0.33). In the static task-oriented condition, the virtual travel agent was manipulated to always use a task-oriented communication style when responding to the customer. Similarly, in the static social-oriented condition, the virtual travel agent was manipulated to always use a social-oriented communication style. In the adaptive social-oriented condition, however, the virtual travel agent was manipulated to mimic the communication style the participants selected in the preceding turn. For example, if the participant chose the social-oriented utterance to greet the agent, then the virtual travel agent replied using a social-oriented communication style. In terms of nonverbal behavior, the travel agent was programmed to perform very subtle head movements including blinking, nodding ad smiling politely to avoid that the participants perceived her as lifeless and unnatural (Koschate et al., 2016). These behaviors were identical across conditions.

Table 1 Design of travel agent communication style conditions and participant replies

	Task-oriented	**Social-oriented**
Examples virtual travel agents	• Welcome to the virtual travel agent.	• Hello, I am Charlotte.
	• To proceed, you must indicate three preferences: A beach holiday or rather a city trip?	• I'm very curious about what else you like: A sunny beach holiday or a nice city trip?
	• The end of the conversation.	• Have a nice day.
Examples participant	• I would like to receive advice about possible holiday destinations.	• Hello! I would be happy to look at possible holiday destinations with you.
	• Preference for flying, a maximum flight time of 3 hours.	• We would like to fly, but preferably less than 3 hours.
	• Okay, clear.	• Thanks, have a nice day!

4.3.5 Measurement instrument

The study measures were adapted from extant literature to suit the context of a travel-related service provided by a conversational agent. Specifically, to measure perceived engagement, a five-item scale from Elliot and Harackiewicz (1996) was used (α = .90). To measure perceived rapport, a ten-item scale from von der Pütten et al. (2010) was used (α = .88). With respect to the relational outcomes, a three-item scale from Barger and Grandey (2006) was used (α = .86) to measure service encounter satisfaction, and a four-item scale from Taylor and Baker (1994) was used (α = .90) to measure intention to use. The items for engagement, rapport, service encounter satisfaction and intention to use are displayed in Table 3. All constructs were measured using seven-point Likert scales in which 1 indicated '*strongly disagree*' and 7 '*strongly agree*'. Finally, the survey included control questions on affinity for technology (7 items) derived from Geissler and Edison (2005) (α =.92), need for social-oriented communication derived from van van Dolen et al. (2007) (α =.80), age, gender, and previous experience with robots.

4.4 Findings

In order to test Hypotheses 1 and 2, we used multiple analysis of variance (MANOVA) with engagement and rapport as dependent variables, as well as polynomial contrast analysis. More specifically, two Helmert contrasts were used to compare each category to the mean effect of all subsequent categories. Therefore, the first contrast compared the static task-oriented condition to the static and the adaptive social-oriented condition together[4]. The second contrast compared the static social-oriented condition to the adaptive social-oriented condition. A Helmert contrast is an orthogonal contrast in which contrasts are unrelated and therefore the Type I error rate is controlled (Field, 2018). A further post hoc analysis (moderation analysis) assessed whether these effects were independent of customers' needs for social-oriented communication, which was measured as a control variable. For these analyses, the software package SPSS was used.

In order to test Hypotheses 3, 4, and 5, partial least squares structural equation modelling (PLS-SEM) was used. PLS-SEM is an iterative combination of principal

[4] Before running the analysis, the conversational data were checked to ensure that for all participants in the adaptive social-oriented condition, at least one social-oriented answer was given by the travel agent. As this was the case, both conditions were substantially different.

components analysis and ordinary least squares path analysis (Chin, 1998). For this analysis, model parameters are estimated in blocks, and multivariate normality is not required (Hair et al., 2012). The software package we used was SmartPLS 3.3.3 (Ringle et al., 2015), and the bootstrapping procedure used 10,000 resamples to generate robust standard errors and t-statistics (Hair et al., 2012).

4.4.1 Communication style and perceived social connection

The MANOVA produced a significant multivariate main effect for the agent's communication style, $F(4, 272) = 3.111$, $p < .05$; Wilk's $\Lambda = 0.916$, partial $\eta 2 = .043$, suggesting significant differences between the three conditions, see Table 2. The polynomial contrast analysis revealed further group differences, which are displayed in Figures 3a and 3b. The first Helmert contrast showed that participants interacting with the agent using a (static or adaptive) social-oriented communication style experienced a significantly ($p < .05$) stronger rapport ($M = 3.94$, $SD = 1.08$) than the participants interacting with the agent using a task-oriented communication style ($M = 3.39$, $SD = 1.18$). However, there was only a marginally significant difference in engagement ($M_{social} = 4{,}78$, $SD = 1{,}19$; $M_{task} = 4{,}37$, $SD = 1{,}37$; $p = 0.06$). Therefore, the results of the first contrast provided support for Hypothesis 1b, but not for Hypothesis 1a.

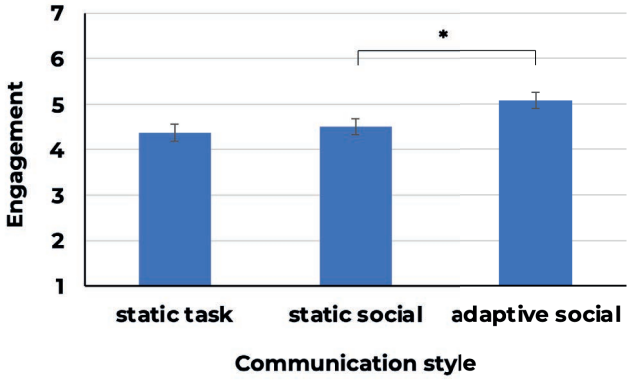
The second contrast showed that participants interacting with the avatar using an adaptive social-oriented communication style experienced significantly ($p < .05$) stronger engagement ($M = 5.07$, $SD = 0.95$) than participants interacting with the avatar using a static social-oriented communication style ($M = 4.50$, $SD = 1.34$). However, there was no significant difference in perceived rapport ($M_{adaptive} = 4.10$, $SD = 0.90$; $M_{static} = 3.37$, $SD = 1.22$; $p = 0.18$). Therefore, the second contrast provided support for Hypothesis 2a, but not for Hypothesis 2b. Taken together, these results show that rapport is mainly affected by the presence of social cues in the agent's communication style (whether statically or adaptively), while engagement is mainly affected by the adaptation to the customer's communication style in the preceding turn.

Table 2 MANOVA with Helmert contrasts on engagement and perceived rapport

Perceived social connection	*F*	df	η_p^2	Helmert contrast 1	Helmert contrast 2
	3.11*	**4, 272**	**0.043**		
Engagement	4.33*	2, 137	0.060		*
Rapport	4.61*	2, 137	0.063	*	

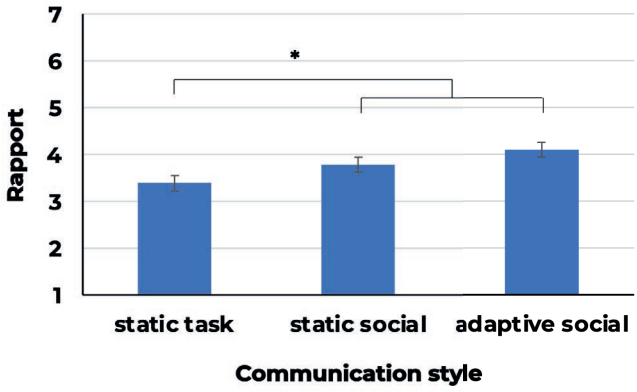
note: *$p < 0.05$. Helmert contrast 1 = the static task-oriented condition compared to the static and the adaptive social-oriented condition together. Helmert contrast 2 = the static social-oriented condition compared to the adaptive social-oriented condition.

Figure 3a Averages and standard errors of engagement per condition



Notes: * $p < 0.05$; Significant effect in Helmert contrast 2

Figure 3b Averages and standard errors of perceived rapport per condition



Notes: * $p < 0.05$; Significant effect in Helmert contrast 1

4.4.2. Perceived social connection and relational outcomes

Evaluation of measurement model

The evaluation of the measurement model addressed its internal reliability, convergent validity and discriminant validity (Hair et al., 2012). First, in support of acceptable internal reliability, the composite reliability values for all multi-item constructs ranged from 0.91 to 0.93 (Table 3), exceeding the recommended threshold value of 0.70 (Hair et al., 2011). Second, convergent validity was established (Table 3), after omitting one item for rapport (item five), after which all average variance extracted (AVE) values exceed 0.50 (Fornell & Larcker, 1981). Third, the square root of the AVE exceeded the inter-construct correlations (Table 4), in support of acceptable discriminant validity (Fornell & Larcker, 1981)

Table 3 Factor loadings, composite reliability and average variance extracted of the constructs and their items

Components and manifest variables	Loading (*t*-value)
Engagement	*CR: 0.930, AVE: 0.728*
It was nice to have a consultation with the travel agent	0.907 (52.71)*
It was boring to have a consultation with the travel agent (r)	0.806 (18.12)*
It was interesting to have a consultation with the travel agent	0.855 (30.34)*
It was exciting to have a consultation with the travel agent	0.822 (25.37)*
It was enjoyable to have a consultation with the travel agent	0.872 (33.42)*
Rapport	*CR: 0.906, AVE: 0.523*
I feel like I had a connection with the travel agent	0.785 (24.69)*
I feel like the travel agent was involved in my story	0.612 (30.40)*
I think the travel agent and I have built a rapport	0.842 (17.35)*
I have a feeling the travel agent was interested in what I said	0.753 (32.70)*
I think the travel agent and I understood each other	0.834 (8.25)*
The travel agent's body language encouraged me to keep talking	0.574 (13.66)*
I feel like the travel agent was not involved in my story (r)	0.726 (5.23)*
The travel agent was warm and caring	0.772 (20.77)*
Being able to see the travel agent helped me focus more on telling my story	0.540 (8.81)*
Service encounter satisfaction	*CR: 0.914, AVE: 0.781*
How satisfied are you with: the support from the travel agent?	0.846 (27.79)*
How satisfied are you with: the way the travel agent treated you?	0.887 (42.29)*
How satisfied are you with: the overall interaction with the travel agent?	0.916 (55.76)*
Intention to use	*CR: 0.932, AVE: 0.775*
The next time I need information from a travel agent I would use this service	0.904 (60.43)*
I will say positive things about this service to other people	0.904 (48.59)*
I plan to make use of this service in the next years	0.844 (25.94)*
I will recommend this service provider to someone who seeks my advice	0.867 (31.22)*

Notes: CR: composite reliability; AVE: average variance extracted; * $p < 0.01$

Table 4 Correlations and square root of the AVE

Construct	1	2	3	4
1. Engagement	0.853			
2. Rapport	0.710	0.880		
3. Service encounter satisfaction	0.695	0.644	0.723	
4. Intention to use	0.778	0.700	0.690	0.883

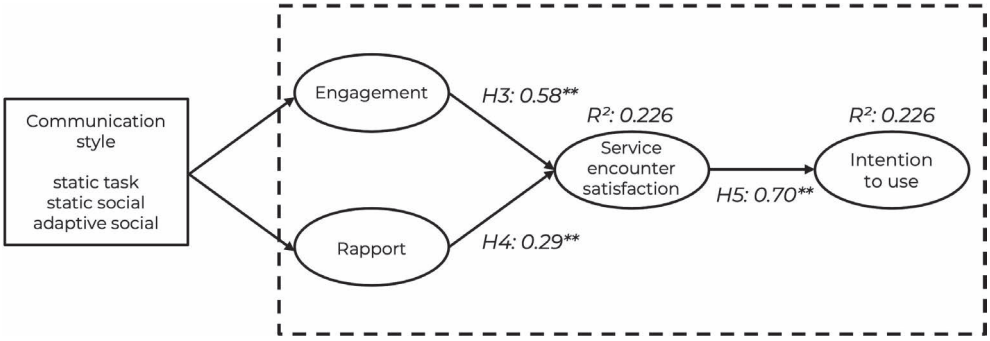
Notes: Values down the diagonal are the square roots of the AVE; all others are correlation coefficients

Evaluation of the structural model

Prior to assessing the structural model and the hypothesized paths, the overall fit of the model was evaluated. As can be observed in Figure 4, the R^2 values for each inner latent construct ranged between 0.490 and 0.648, indicating medium effect sizes (Chin, 1998). Tenenhaus et al. (2005) instead propose a goodness-of-fit (GoF) index to examine the model fit, in which $GoF = \sqrt{\overline{communality} \times \bar{R}^2}$. The obtained GoF value of 0.62 indicates large effect sizes (Wetzels et al., 2009).

First, the structural model results (Figure 4) indicated that engagement (β = 0.577, p<0.01) and perceived rapport (β = 0.289, *p*<0.01) had a statistically significantly positive effect on service encounter satisfaction (R^2 = 0.648). Therefore, the structural model results provided support for H3 and H4. In addition, the results indicate that service encounter satisfaction had a significantly positive effect (β = 0.700, *p*<0.01) on intention to use (R^2 = 0.490), which supports H5. In summary, the structural model results provide support for Hypotheses 3, 4, and 5 on the right side of the conceptual model.

Figure 4 Structural model results



Notes: **: path coefficient meets or exceeds *p* < 0.01 (2-tailed); *: meets or exceeds *p* < 0.05 (2-tailed)

In a further post hoc analysis, the interaction term between communication style and customer self-reported need for social-oriented communication was added to the MANOVA model. The results showed that the effects of communication style were not moderated by the need for social-oriented communication.

4.5 Discussion

Research on the effects of HCBs in conversational agents is becoming increasingly prevalent (Ling et al., 2021; Moriuchi, 2021). While many of these studies support the notion that the use of HCBs by conversational agents enhances relational outcomes (Araujo, 2018; Verhagen et al., 2014), the use of verbal behaviors that signal responsiveness has yielded mixed effects (see chapter 2). The use of a social-oriented communication style is a prime example of such behavior. Previous research has indicated that conversational agents should adapt to customers' needs, yet, do not provide an answer on how conversational agents should do that (Chattaraman et al., 2019; Derrick & Ligon, 2014). Therefore, the current study compares two different implementations of a social-oriented communication style by conversational agents.

The empirical evidence displayed in Figures 3a and 3b shows that the communication style of the conversational agent does affect the perceived social connection with the customer. Although customers experienced the highest levels of engagement and perceived rapport (rapport) when the avatar used an adaptive social-oriented communication style, the polynomial contrast analysis showed that communication style affects these mediators differently. The increase in engagement was mainly influenced by the adaptation to the customer (adaptive social communication style), while the increase in perceived rapport was mainly influenced by the presence of social-communicative cues (implemented either statically or adaptively). Therefore, the results of our study show that different hurdles need to be taken to establish a social connection with the customer; conversational agents need to use a social-communication style to establish a rapport with the customer, but need to do so in an adaptive manner to also establish engagement.

4.5.1 Theoretical implications

The findings of this study have several theoretical implications. First, this is the first study to show that mimicry of communication style enhances the perceived

social connection with the customer. Previous studies support the notion that using mimicry of the customer's appearance (Dotsch & Wigboldus, 2008; Vugt et al., 2010) and nonverbal behaviors (Bailenson & Yee, 2005; K.M. Lee et al., 2006b) acts as a 'social glue' establishing a social connection with the customer (Lakin & Chartrand, 2003). This study shows that this effect also occurs when conversational agents mimic the customer's communication style. Future research should investigate whether these positive effects are also obtained for mimicry of specific verbal behaviors that in the current study have been combined into the concept of social-oriented communication, such as empathy or small talk.

Second, previous studies have suggested that service designers and managers should take the customers' communicative needs into account in the design of conversational agents (Chattaraman et al., 2019; Derrick & Ligon, 2014). Li and Mao (2015) have proposed mimicry as a method to take customers' needs into account, but until now this strategy had never been compared to a (static) adaptation to customers' predefined needs (i.e., using social-oriented communication only if customers indicate this as a preference beforehand). Our post hoc analysis revealed that the advantage of an adaptive social-oriented communication style is independent of customers' self-reported need for social-oriented communication. Therefore, the outcomes of this study suggest that mimicry is the most effective strategy to accommodate customers' needs.

Lastly, as previously mentioned, the current literature on the social connection between customers and conversational agents, contains multiple operationalizations of the customer's perceived social connection with these agents. More specifically, the literature on human-machine interaction shows a division between the use of engagement (Ivaldi et al., 2017; Ling et al., 2021; Moriuchi, 2021; Sidner et al., 2014) and rapport (Cerekovic et al., 2017; Gratch et al., 2007; von der Pütten et al., 2010), while in the service marketing literature, yet another conceptualization of rapport is used more commonly (DeWitt et al., 2008; Gwinner et al., 1998). As operationalizations from the service marketing literature can be difficult to apply to conversational agents and HCBs have been connected to both engagement and rapport in the human-machine interaction literature, this study included these two as outcome variables. Interestingly, our results show that engagement and rapport are influenced by different cues in the agent's social-oriented communication style. Therefore, researchers in the field of human-machine interaction should be careful when exclusively using

rapport or engagement as an indication of perceived social connection with a conversational. Rather, they are recommended to measure both concepts in order to further investigate the differences between them. In addition, future research is recommended to refine the conceptualization of perceived social connection with conversational agents. Lastly, researchers are encouraged to unify the differences in the conceptualizations of rapport in the human-machine interaction literature and the service marketing literature.

4.5.2 Practical implications

Successfully deploying conversational agents in service encounters can provide benefits for both customers and service providers (Curran & Meuter, 2005). However, to take full advantage of these benefits, it is important that customers experience a social connection with the conversational agent, just like in human-to-human service interactions (Li & Mao, 2015; von der Pütten et al., 2010). The results of this study provide guidelines for industry practitioners who want to incorporate conversational agents into their service. In the literature it is often assumed that as conversational agents are used to fulfil relatively straightforward tasks, their communication style should also be task-oriented (Clark et al., 2019; Stein & Ohler, 2017). Yet, in practice, many service providers choose the strategy of utilizing a social-oriented communication style in their conversational agents, by including utterances like '*excellent choice*' or '*that is nice, please tell me more!*'. This study shows that the use of such a communication style in conversational agents indeed enhances the social connection with the customer, especially when such a social-oriented communication style is applied in response to a social-oriented utterance by the customer. Therefore, service managers are recommended to implement a social-oriented communication style in their conversational agents. Even if it is technically not possible to implement such a communication in an adaptive manner, it will still help to enhance the customer's experience of rapport with the agent.

4.5.3 Limitations

Although this study offers insight into which communication style conversational agents should use to establish a social connection with customers, it also has some limitations. First, caution needs to be exercised when extending these findings to a different service context. Keeling et al. (2010) have demonstrated that a task-

oriented communication style is more suitable in a pronounced utilitarian service context and a social-communication style is more suitable in a pronounced hedonic service context. This study utilized a service context including both utilitarian and hedonic aspects. Therefore, future research should examine whether the same findings are obtained in service context that is more utilitarian.

Second, the adaptive social-oriented communication style yielded the highest levels of both rapport and engagement, yet, with the current experimental set-up, we were unable to unravel whether this effect is due to mimicry or to the presence of variation in the conversational agent's communication style. Moreover, it might have felt unnatural for the participants to choose between two possible answering options during every turn. It is possible that respondents felt that neither of the answering options matched the reply they would have given in real-life. Consequently, they may not have perceived the manipulation as mimicry of their own communication style, but rather as variation in the communication style utilized by the conversational agent. If the effects are due to mimicry, researchers in the field of robotics might attempt to build an algorithm that is able to recognize the communication style of written text and respond accordingly. To our knowledge, there are currently no studies evaluating the effectiveness of such an algorithm empirically.

Third, the results of the current study are likely influenced by the cultural background of the participants. Other studies have shown that culture influences the tendency to engage in anthropomorphism and consequently also moderates the effects of HCBs in conversational agents (Epley et al., 2007). For example, Rau et al. (2010) have manipulated a different dimension of communication style (explicit versus implicit) in a robot and investigated the effects on customers' acceptance of recommendations made by the robot. The results showed that compared to the German participants, Chinese participants evaluated the implicit robot as more likable, trustworthy, and credible, and were more likely to accept the implicit recommendations. Therefore, future studies should investigate how culture moderates the effects of communication style in conversational agents.

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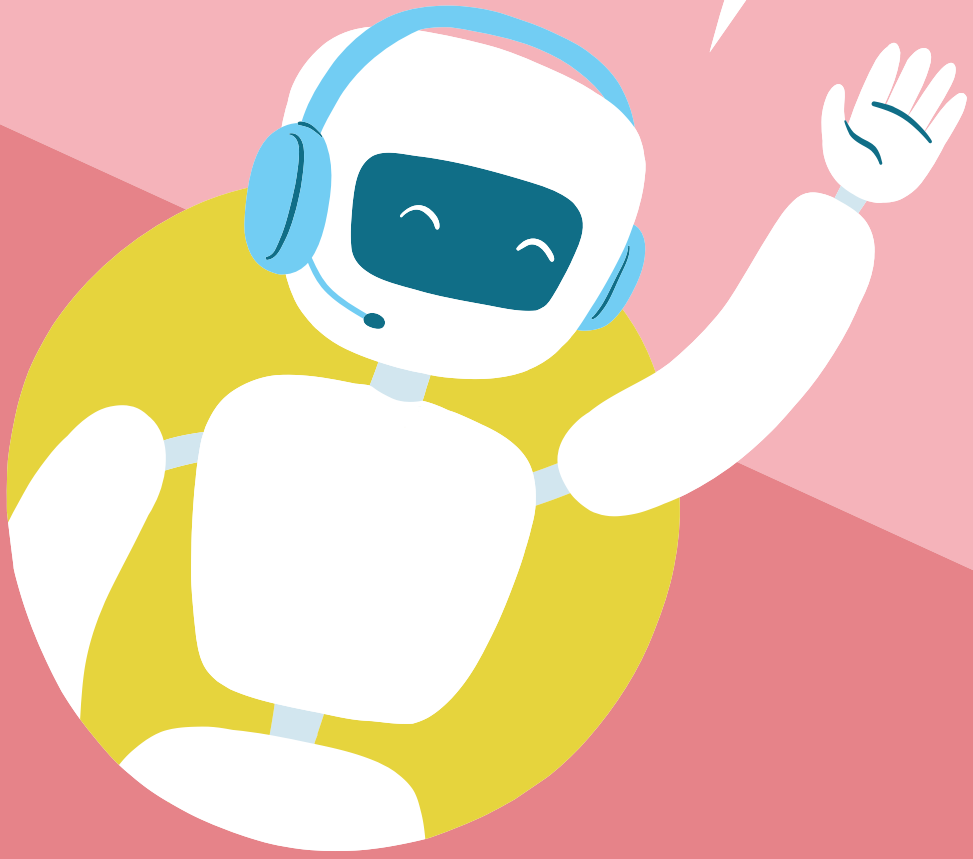
CHAPTER 5
TRUST IN HUMANOID ROBOTS: IMPLICATIONS FOR SERVICES MARKETING



5.1 Introduction

Self-service technologies (SSTs) promise to revolutionize the interactions of users with service providers and radically shift the very nature of services (Kaushik & Rahman, 2015; Meuter et al., 2000). These '*technological interfaces that enable customers to produce a service independent of direct service employee involvement*' (Meuter et al., 2000, p. 50) take various forms in public service settings, including automated teller machines, self-service kiosks and self-checkouts (Collier et al., 2017; Curran & Meuter, 2005). The latest generation of SSTs relies on service robots (Severinson-Eklundh et al., 2003), which can physically replace human service employees (Edwards, 2014; Oh et al., 2013) and thus increase the level of service while decreasing costs (Allmendinger & Lombreglia, 2005; Bitner, 2001). Because service providers recognize this potential, more than 6.7 million service robots (International Federation of Robotics, 2017) are in operation; in hotels providing information to guests (Pinillos et al., 2016), in restaurants taking orders (Qing-xiao et al., 2010) and in stores assisting customers (Gross et al., 2002). Market reports predict that by 2020, 85 per cent of services will be provided without human involvement (Gartner, 2011; IDC, 2017) and the global service robotics market will be worth more than US$7.3 billion (Ambasna-Jones, 2017).

Despite this potential, a key factor hinders the integration of service robots, namely users' lack of trust (Everett et al., 2017; B. Morgan, 2017). Marketing research identifies trust as a strong determinant of intentions to use a service through enjoyment (Wu & Chang, 2005). Although, there are more relationship quality indicators or 'relational mediators' (see chapter 1), particularly trust seems to hinder the integration of service robots. If users do not enjoy or intend to use service robots, the cost savings and bottom-line benefits will remain untapped (e.g., Allmendinger & Lombreglia, 2005; Bitner, 2001), and extant research offers few insights into the drivers of trust in service robots. Traditional SST research pertaining to services mainly focuses on automated teller machines (Curran & Meuter, 2005), self-scanning devices (Kaushik & Rahman, 2015), self-service kiosks (Collier et al., 2014) or self-checkouts (Collier et al., 2017). In particular, SST studies of service robots are scarce and mostly descriptive (Kaushik & Rahman, 2015), illustrating the need for experimental research (Gelbrich & Sattler, 2014). To address this gap, the current study seeks to identify antecedents and consequences of trust in service robots by focusing on a central concept in research on human-machine: anthropomorphism (Epley et al., 2007).

Anthropomorphism is the human tendency to assign human capabilities, such as rational thought and feelings, to inanimate objects such as robots (Waytz et al., 2014). According to theory, anthropomorphism is easier if the robot is equipped with human-like features, such as a human face (Aggarwal & McGill, 2007; Epley et al., 2007). Research has also shown that higher levels of anthropomorphism increase trust in robots (Brave et al., 2005; Kiesler et al., 2008; Luo et al., 2006; Richards & Bransky, 2014; Waytz et al., 2014). This evidence has fueled the development of humanoid robots with human-like facial expressions, voices and names (Fink, 2012). Although the effects of some human-like features on trust have been investigated, it is not clear which features increase trust most.

Anthropomorphism theory provides two contrasting perspectives on this question (Epley et al., 2007). First, the elicited agent knowledge perspective stipulates that non-humans are anthropomorphized more readily when they possess observable human-like features and appearances. Second, the sociality motivation perspective proposes that non-humans are anthropomorphized more readily when they possess features resembling humans' social functioning, like the possibility to display nonverbal communication cues. From a design perspective, this discrepancy raises interesting issues, because robots designed to mimic humans' social functioning do not necessarily resemble humans in appearance. Therefore, this study aims to investigate which features (appearance vs. social functioning) affect anthropomorphism most, by focusing on gaze turn-taking cues. Recently developed service robots can display gaze turn-taking cues, by changing the color of their eyes, such that they mimic humans' social functioning. At the same time, this makes them more dissimilar from humans in appearance, whose eye color cannot be changed. The experimental field study for this research required the humanoid robot to display these gaze cues in one condition but not in the other. This functionality allowed us to investigate what is more effective for increasing anthropomorphism (and trust): social functioning features that are more human-like, or appearance features that are more human-like.

The contributions of this study are both theoretical and practical. First, it sheds new light on the contrasting perspectives about the elicitation of anthropomorphism, arising from the theory proposed by Epley et al. (2007). Second, it represents an initial effort to combine central concepts in research on human-machine (i.e., anthropomorphism and enjoyment) with notions from SST adoption literature (i.e., trust) to gain insight into users' adoption of service robots (Fan et al., 2016; Kaushik

& Rahman, 2015). Third, from a practical perspective, this expanded knowledge provides some concrete design guidelines for managers of companies that design and program service robots.

5.2 Literature review

5.2.1 Anthropomorphism

According to research on human-machine interaction, the design of attribute features in humanoid robots should reflect the understanding that '*for a robot to be understandable to humans as other humans are, it must have a naturalistic embodiment, interact with the environment in the same way as living creatures do and perceive the same things humans find to be salient and relevant*' (Fong et al., 2003, p.5). The integration of human-like features is believed to influence users' perceptions of robots, through the cognitive process of anthropomorphism (Epley et al., 2007). In this process of inductive inference, humans attribute essential human traits, such as feelings or rational thought, to a robot in an effort to understand its otherwise unpredictable behavior (Aggarwal & McGill, 2007; Eyssel et al., 2011; Waytz et al., 2014). As a result of this understanding, users prefer robots with greater human-likeness as interaction partners which has fueled the development of robots with obvious human-like features, such as faces or voices (Kiesler et al., 2008; Złotowski et al., 2015). Brian R. Duffy (2003, p.179) states that a robot's capacity to engage in human interaction requires a degree of human-like qualities, either in appearance, behavior or both, yet anthropomorphism theory is ambiguous about the way in which human-like qualities should be implemented.

5.2.2 Antecedents of anthropomorphism

Epley et al. (2007) describe three psychological mechanisms that explain why people anthropomorphize: effectance motivation (to explain and understand the behavior of other agents), elicited agent knowledge (applicability of anthropocentric knowledge) and sociality motivation (desire for social contact and affiliation). The effectance motivation involves humans' individual motivations to interact appropriately with a robot and explain its behavior; elicited agent knowledge and the sociality motivation instead revolve around the characteristics of the robot and are therefore more relevant from the perspective of this study.

The elicited agent knowledge mechanism stipulates that knowledge about humans is more readily available and richly detailed for humans than knowledge about non-human agents (Epley et al., 2007). Therefore, humans use it as a basis for their inductive reasoning when they observe human features in non-human agents. The more morphologically similar a robot is in its observable features, the more likely humans are to use themselves as a source of induction and engage in anthropomorphism (Krach et al., 2008). This mechanism recommends incorporating human-like characteristics, like faces and bodies, in the design of robots in order to enhance their human-like appearance (Burgoon et al., 2000; DiSalvo et al., 2002).

The sociality motivation mechanism instead implies that humans need to establish social connections with others (Epley et al., 2007). If such social connections are not available, people anthropomorphize robots to satisfy this need, by focussing on the features that facilitate social functioning during an interaction, including nonverbal cues. The more physiognomically similar a robot is in its social functioning, the more likely humans are to use themselves as sources of induction and anthropomorphize. This mechanism then suggests including human-like characteristics such as gaze, memory and gestures in the design of service robots (Mutlu et al., 2009; Richards & Bransky, 2014; Salem et al., 2013). However, robots designed to resemble humans in social functioning do not necessarily resemble humans in appearance. This study aims to unravel these two contradictory perspectives, by focusing on the use of gaze turn-taking cues.

5.2.3 Gaze turn-taking cues

Turn-taking is a universal mechanism for coordinating interaction, regulating who speaks and when (Stivers et al., 2009; Sacks et al., 1974) and indicating interaction roles such as the addressee, bystander or overhearer (Goffman, 1979). To facilitate interactions, humans use multiple turn-taking cues. Duncan (1972) distinguishes six groups of cues—intonation, paralanguage, body motion, sociocentric sentences, pitch and syntax—that signal three different turn-taking intentions: turn-yielding or attempting to take the turn, suppressing or attempting to keep the turn and back-channeling or attempting to let the interlocutor keep the turn.

Although turn-taking cues are difficult to implement in robots, recent technological advances enable some displays of gaze turn-taking cues (Mutlu et al., 2009). Gaze

cues are body motions, or specifically eye motions, that signal an intention of the speaker to an interlocutor (Goodwin, 1980; Sacks et al., 1974). A new generation of robots can display gaze turn-taking cues by changing the color of their eyes (Ivanov et al., 2017). For example, the eyes of the humanoid robot Pepper (Softbank Robotics, 2017) turn red when it recognizes the interlocutor, thus indicating a yielding intention; green when it speaks, to indicate a suppressing intention; and blue when waiting for input, signaling a back-channeling intention. Humans' eye colors are static, so such gaze turn-taking cues do not resemble humans in appearance but solely in social functioning, which makes them particularly suitable to test the contrasting perspectives offered by anthropomorphism theory (Epley et al., 2007). Doing so requires incorporating a variable that can explain the circumstances in which resemblance in appearance takes precedence over social functioning, or vice versa—namely, comfort.

5.2.4 Perceived interaction comfort

According to the comfort thesis (DiSalvo & Gemperle, 2003, p.68), interaction comfort is the primary emotional motivation for anthropomorphism. Similarly, Berger and Calabrese's (1974) uncertainty reduction theory predicts that during interactions, people need information about an interlocutor to reduce uncertainty about its future behavior. Being unable to obtain this information causes discomfort and triggers the use of uncertainty reduction strategies (Berger, 1986), including an increased focus on cues that provide social information, such as eye contact. When experiencing discomfort during an interaction with non-humans, humans similarly search for social cues they can use to predict their interlocutors' behavior (Mourey et al., 2017). Therefore, interaction discomfort appears to increase human motivations to anthropomorphize social functioning cues in robots. Conversely, when people do not feel discomfort, the uncertainty reduction strategies are not triggered, as a results of which they do not rely on social cues to obtain social information such as eye contact. Furthermore, psychological research on cognitive processing shows that when humans experience neutral to positive emotions, interaction cues are processed less carefully and they use more superficial or cursory styles of thinking compared to humans who experience negative stress-related emotions such as discomfort (R. Baron et al., 1994; Bodenhausen et al., 1994). Therefore, we propose that the effect of the humanoid service robot's gaze turn-taking cues on users' perceived anthropomorphism is moderated by perceived interaction comfort, such that:

H1a: When perceived interaction comfort is high, the effect of gaze turn-taking cues on anthropomorphism is attenuated.

H1b: When perceived interaction comfort is low, the effect of gaze turn-taking cues on anthropomorphism is strengthened.

5.2.5 Trust

Services marketing research assesses trust in business-to-business contexts (Coulter & Coulter, 2002), retailing (Nguyen et al., 2014), financial services (Sekhon et al., 2013), healthcare (Auh, 2005) and e-commerce (Harris & Goode, 2010), but only a few studies examine trust in SSTs (Chowdhury et al., 2014; Kauskin & Rahman, 2015; Robertson et al., 2016). However, as research identifies trust as a strong determinant of intentions to use a service (Gefen et al., 2003), current literature highlights the need to understand drivers of trust in SSTs (Kaushik & Rahman, 2015) and service robots in particular (Wirtz et al., 2018). In the field of human-machine interaction, anthropomorphism has not only been identified as a strong determinant of user preference, but also of perceived trust (B.R. Duffy, 2003, Brave et al., 2005; Kiesler et al., 2008; Luo et al., 2006; Richards & Bransky, 2014; Waytz et al., 2014). Trust is a multidimensional concept, reflecting the perceived competence, integrity and benevolence of another entity (Mayer et al., 1995). When humans ascribe human capabilities, such as rational thought and feelings, to a robot, perceptions of the robot's competence to perform its intended function are enhanced (B.R. Duffy, 2003). For example, Gong (2008) shows that virtual characters with a more human-like appearance are perceived as more competent to make decisions and trusted more. Therefore, features related to the robot itself, such as its appearance and functionality, are important for establishing trust with the user (Hancock et al., 2016). Thus,

H2: Users' perceived anthropomorphism of a humanoid service robot has a positive effect on users' perceived trust.

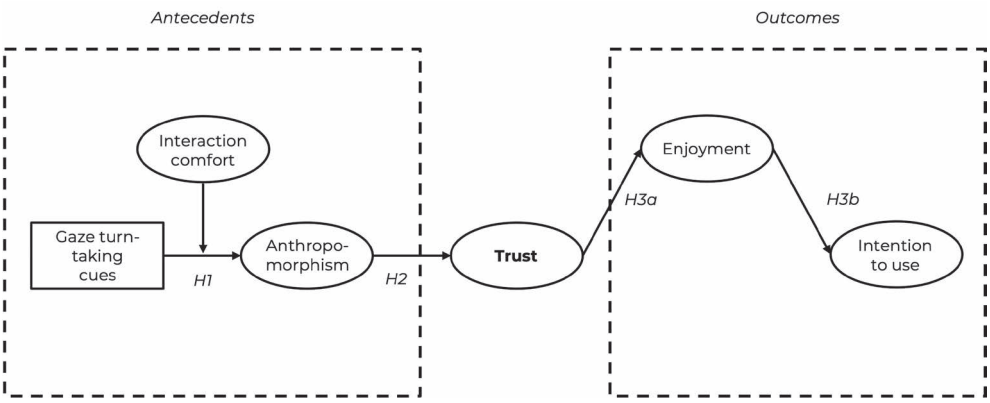
5.2.6 Perceived enjoyment and intention to use

Early e-commerce studies indicate that perceived enjoyment mediates the relationship between trust and intentions to use (Sukhu et al., 2015; Wu & Chang, 2005). Researching the intentions to use service robots is crucial to reap their full benefits, for both users and service providers (Curran & Meuter, 2005). In research on

service robots, a lack of trust is frequently cited as the main hindrance, preventing users from having the intention to use the service robot (Everett et al., 2017; B. Morgan, 2017). Research in various services marketing contexts, such as business (e.g., Barry et al., 2008), retailing (Nguyen et al., 2014) and SSTs (Chowdhury et al., 2014; Kaushik & Rahman, 2015), demonstrates that trust drives behavioral intentions. Furthermore, trust is included in multiple versions of the technology acceptance model as a predictor of intentions to use (Gefen et al., 2003). Studies in robotics often explain this relationship through flow theory (Nakamura & Csikszentmihalyi, 2014), which proposes that if people experience a feeling of total involvement when interacting with a robot, characterized by high perceived trust and interactivity, they enter a state of flow; that is a mental state of high enjoyment that intrinsically motivates people to continue using the service (El Shamy & Hassanein, 2017; K.C. Lee et al., 2007; Y. Lu et al., 2009; Wu & Chang, 2005; Zhou et al., 2010; Zhou, 2020). In parallel, multiple studies on human-machine interaction indicate that enjoyment is an important driver of behavioral intentions (Heerink et al., 2008; Hong et al., 2008). Thus,

> **H3:** Users' perceived enjoyment fully mediates the effect of perceived trust on users' intentions to use humanoid service robots, such that (a) users' perceived trust has a positive effect on perceived enjoyment and (b) their perceived enjoyment has a positive effect on users' intentions to use humanoid service robots.

Figure 1 Conceptual model and hypotheses



5.3 Methodology

The conceptual model was tested with a field study in a public service setting. Humanoid service robots are increasingly being integrated into public service settings to enhance service experience (Edwards, 2004; Fan et al., 2016). They welcome visitors and provide location-specific information (Gockley et al., 2005; Kanda et al., 2010; Leite et al., 2013; Pinillos et al., 2016; Severinson-Eklundh et al., 2003), which are crucial tasks in public spaces (Duranti, 1997; M.K. Lee & Makatchev, 2009; Pan et al., 2015).

5.3.1 Participants

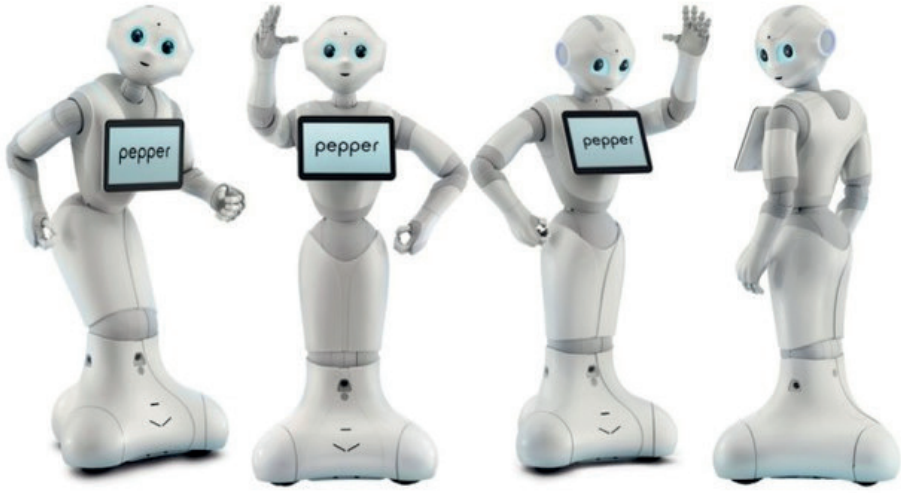
An open innovation campus in the south-eastern part of the Netherlands provided the public service setting. Several start-ups and well-established companies are located on-site, including a leading global professional services company. Visitors to the campus enter through a main entrance, which features a reception desk. A Pepper humanoid service robot (Figure 2) was placed close to this reception desk, tasked with welcoming visitors and employees and offering directions to specific locations on the campus. A total of 116 respondents participated in the study, but excessive missing values resulted in the exclusion of 2 respondents, leaving a final sample of 114 participants. The average age of the participants was 34 years, 35% of them were women and 56% had prior experience with robots.

5.3.2 Procedure

The humanoid service robot Pepper can display turn-taking cues with its eyes (Softbank Robotics, 2017). Several other features enable Pepper to interact with humans in a natural and intuitive way. First, a network of internal sensors, including ultrasound transmitters and receivers, laser sensors and obstacle detectors, provide the robot with information about objects within a range of 3 meters. Second, four directional microphones in the robot's head and speakers allow recognition of the interlocutor's location and emotions, as transmitted by voice. Third, a 3D camera and two HD cameras transmit images, processed by shape recognition software, so Pepper can identify faces and objects, movements and facial expressions of emotions. Fourth, tactile sensors in the humanoid service robot's hands facilitate social interactions (Softbank Robotics, 2017).

Upon entry to the campus, participants were invited to interact with the humanoid service robot and asked for permission to record the interaction on camera. If permission was granted, the participant walked up to the robot. The interaction started with the robot welcoming the participant and asking how he or she was doing, to ensure a natural interaction. The features of the robot remained constant, and it offered appropriate responses to the participant's comments. Subsequently, the robot asked the participant for the reason for the visit and where the participant wanted to go. In response, the robot provided appropriate information about the exact location while physically pointing in that direction. Finally, participants filled out a survey on a tablet provided by the researcher.

Figure 2 Pepper the humanoid service robot



5.3.3 Design and measurement

This field experiment used a one-factor, between-subjects experimental design. In one condition, the robot's eye color was constant, resembling human appearance (henceforth referred to as the static condition). In the other condition, the service robot sent gaze turn-taking cues by changing eye color between red (robot noticed and/or recognized a person), blue (robot is ready to receive input), green (robot is speaking and/or moving) and white (robot is starting the application), which mimics human social functioning (henceforth referred to as the dynamic condition). As the experiment was conducted in a real-life setting, the robot was not reprogrammed between participants. Therefore, participants were non-randomly assigned to

conditions, however no differences between conditions were found in participants' age, gender and previous experience, which are important drivers of anthropomorphism (Epley et al., 2007) intentions to use robots (de Graaf & Ben Allouch, 2013). Participants were not informed of the meaning of the colors, because turn-taking in interactions between humans also gets learned during the conversation (Stivers et al., 2009). The experiment took place over a three-day period and yielded 60 valid responses in the static condition and 54 valid responses in the dynamic condition.

Table 1 Factor loadings, composite reliability and average variance extracted of the constructs and their items

Components and manifest variables	Loading (t-value)
Perceived anthropomorphism	*CR: 0.824, AVE: 0.542*
How did you perceive the robot: Fake/Natural	0.837 (19.88)*
How did you perceive the robot: Machine-like/Human-like	0.744 (10.87)*
How did you perceive the robot: Unconscious/Conscious	0.701 (7.96)*
How did you perceive the robot: Moving rigidly/Moving elegantly	0.649 (7.16)*
Trust	*CR: 0.838, AVE: 0.635*
I felt like the robot had my best interest at heart	0.720 (9.62)*
The robot provided accurate information	0.786 (13.78)*
I felt I could rely on the robot to do what was supposed to do	0.877 (30.45)*
Perceived enjoyment	*CR: 0.887, AVE: 0.663*
The interaction with the robot made me feel: Unhappy/Happy	0.860 (31.27)*
The interaction with the robot made me feel: Annoyed/ Pleased	0.761 (9.34)*
The interaction with the robot made me feel: Unsatisfied/ Satisfied	0.843 (29.35)*
The interaction with the robot made me feel: Bored/Relaxed	0.789 (15.56)*
Intention to use	*CR: 0.923, AVE: 0.857*
I intend to use robots in the future	0.924 (42.92)*
Using robots is a good idea	0.927 (49.04)*

Notes: CR: composite reliability; AVE: average variance extracted; * $p < 0.01$

The study measures were adapted from extant literature to suit the humanoid service robot context. Specifically, the measures for perceived anthropomorphism (five items) came from Bartneck et al. (2009b); perceived interaction comfort (one

item, 'I felt comfortable interacting with the robot') was derived from work by Evers et al. (2008); trust (four items) came from Mayer et al. (1995); perceived enjoyment (four items) was adapted from Kulviwat et al. (2007); and intentions to use (two items) were based on work by Jackson et al. (1997). The anthropomorphism and enjoyment items relied on five-point semantic differential scales (see Table 1). All other constructs were measured using five-point Likert scales in which 1 indicated 'strongly disagree' and 5 'strongly agree.' The survey also included questions about age, gender and previous experience with robots.

5.4 Findings

Partial least squares structural equation modelling (PLS-SEM) – an iterative combination of principal components analysis and ordinary least squares path analysis (Chin, 1998) – was used to test the proposed model. For relatively small sample sizes, PLS-SEM is more robust, because the model parameters are estimated in blocks, and multivariate normality is not required (Hair et al., 2012). The software package was SmartPLS 3.2 (Ringle et al., 2015), and the bootstrapping procedure used 10,000 resamples to generate robust standard errors and t-statistics (Hair et al., 2016).

5.4.1 Evaluation of measurement model

Prior to evaluating the measurement model, the trust measure and the perceived interaction comfort measure were subjected to a square root transformation, due to their strong negative skewness (Freeman & Tukey, 1950; Tukey, 1957). The evaluation of the measurement model addressed its internal reliability, convergent validity and discriminant validity (Hair et al., 2016). First, in support of acceptable internal reliability, the composite reliability values for all multi-item constructs ranged from 0.82 to 0.92 (Table 1), exceeding the recommended threshold value of 0.70 (Hair et al., 2011). Second, convergent validity was established (Table 1), after omitting one item for anthropomorphism and one item for trust, because all average variance extracted (AVE) values exceed 0.50 (Fornell & Larcker, 1981). Third, the square root of the AVE exceeded the inter-construct correlations (Table 2), in support of acceptable discriminant validity (Fornell & Larcker, 1981).

Table 2 Correlations and square root of the AVE

Construct	1	2	3	4	5	6
1. Gaze turn-taking cues	[a]					
2. Perceived interaction comfort	0.055	[b]				
3. Anthropomorphism	-0.091	0.271	0.736			
4. Trust	-0.090	0.454	0.475	0.797		
5. Enjoyment	-0.014	0.483	0.548	0.484	0.814	
6. Intention to use	0.016	0.303	0.359	0.267	0.408	0.926

Notes: Values down the diagonal are the square roots of the AVE; all others are correlation coefficients; [a] manipulation; [b] single-item scale

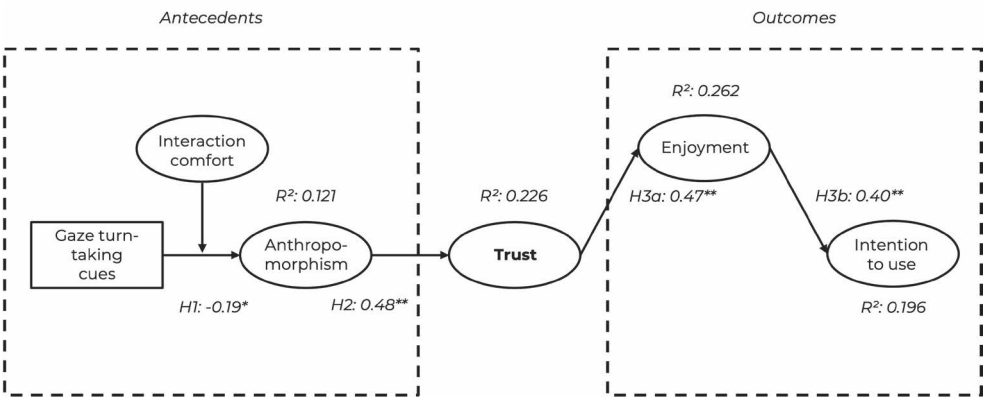
5.4.2 Evaluation of structural model

Prior to assessing the structural model and the hypothesized paths, the overall fit of the model was evaluated. As can be observed in Figure 3, the R^2 values for each inner latent construct range between 0.121 and 0.262, indicating small to medium values (Chin, 1998). Tenenhaus et al. (2005) instead propose a goodness-of-fit (GoF) index to examine the model fit, in which $GoF = \sqrt{communality \times \bar{R}^2}$. The obtained GoF value of 0.42 indicates large effect sizes (Wetzels et al., 2009).

First, the structural model results (Figure 3) indicate that H1a is statistically significant at $p < 0.05$, while H1b is not. Moreover, the path coefficients for H2, H3a and H3b are statistically significant at $p < 0.01$. The effect of gaze turn-taking cues on perceived anthropomorphism is moderated by perceived interaction comfort ($\beta = -0.185$, $p < 0.05$; $R^2 = 0.121$). An illustration of the moderation effect, Figure 4 shows that perceived anthropomorphism is higher for a service robot without gaze turn-taking cues (M = 3.69) than for a robot with gaze turn-taking cues (M = 3.18) when perceived interaction comfort is high. In contrast, when perceived interaction comfort is low, perceived anthropomorphism is higher for a robot with gaze turn-taking cues (M = 3.06) than for a robot without this ability (M = 2.98). Figure 5 shows where the conditional slope differs significantly from 0, for the standardized latent variables scores. Above the point when perceived interaction comfort is 0.49 SDs above the mean (standardized latent variable scores), the slope of gaze turn-taking cues is significantly different from 0 and negative ($p < 0.05$). Although directionally as expected, the effect is not significant for low comfort. Thus, together these graphs show that perceived anthropomorphism is higher for a service robot without gaze turn-taking cues than for a robot with this ability

when perceived interaction comfort is high. Furthermore, trust can be explained by perceived anthropomorphism ($\beta = 0.475$, $p < 0.01$; $R^2 = 0.226$), and trust does not drive intention to use directly ($\beta = 0.08$, $p > 0.10$; $R^2 = 0.196$); rather, its effect is fully mediated by perceived enjoyment (indirect effect: $\beta = 0.187$, $p < 0.01$), to the extent that more trust is associated with higher perceived enjoyment ($\beta = 0.472$, $p < 0.01$; $R^2 = 0.262$), and perceived enjoyment correlates positively with intentions to use ($\beta = 0.396$, $p < 0.01$; $R^2 = 0.196$).

Figure 3 Structural model results



Notes: **: path coefficient meets or exceeds $p < 0.01$ (2-tailed); * meets or exceeds $p < 0.05$ (2-tailed); ns: non-significant

Figure 4 Results of simple slopes analysis of the interaction between gaze turn-taking and perceived comfort on perceived anthropomorphism

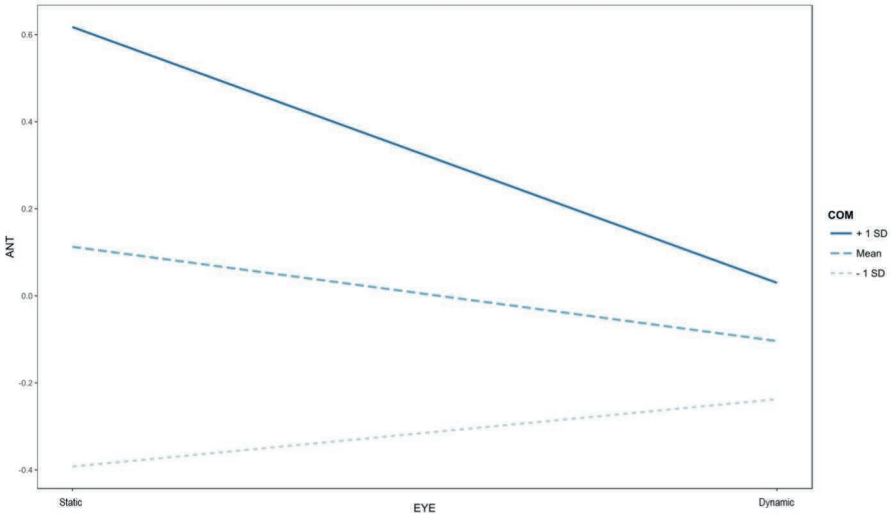
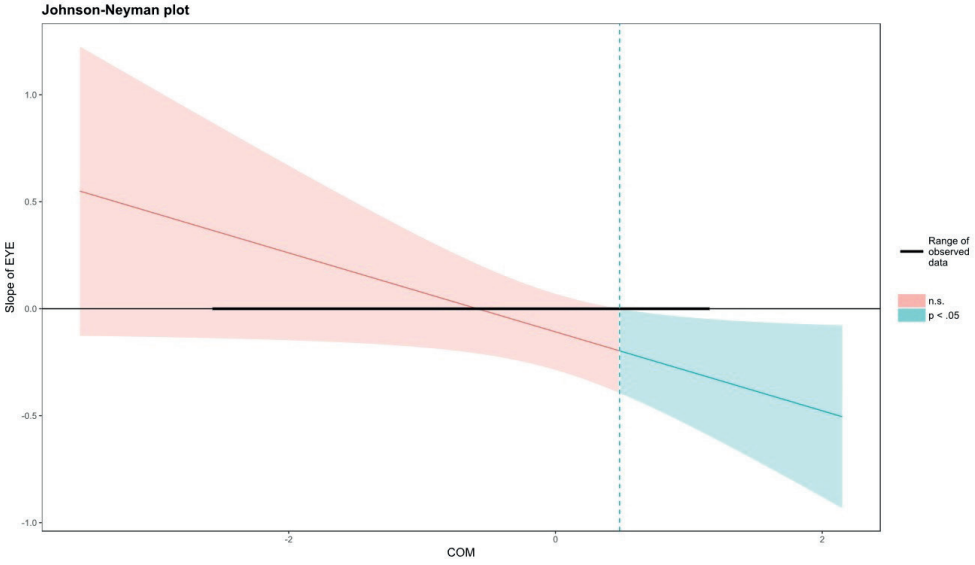


Figure 5 Conditional effect of the interaction between gaze turn-taking and perceived comfort on perceived anthropomorphism



5.5 Discussion

In the reported experimental field study, a humanoid robot displayed gaze turn-taking cues in one condition and none in the other, revealing whether a more human-like appearance or more human-like social functioning has the strongest effect on anthropomorphism and trust. The empirical evidence in Figures 3 and 4 highlights several key findings. First, the results provide support for a moderating role of perceived interaction comfort on the effect of gaze turn-taking cues on perceived anthropomorphism. When perceived interaction comfort is high, perceived anthropomorphism is significantly higher for a service robot without gaze turn-taking cues. The increased human-like appearance outweighs social functioning in terms of encouraging anthropomorphism toward service robots. When perceived interaction comfort is low, perceived anthropomorphism is directionally but not significantly higher for a service robot with turn-taking cues, suggesting that social functioning outweighs appearance in prompting such anthropomorphism. Second, perceived anthropomorphism drives trust in humanoid service robots, in line with previous research on human-machine interaction (de Visser et al., 2016; Hancock et al, 2011; Heerink et al., 2010; Waytz et al., 2014). Third, consistent with existing literature, trust correlated positively with

perceived enjoyment (K.C. Lee et al., 2007; Wu & Chang, 2005; Zhou et al., 2010), which in turn enhances intentions to use humanoid service robots (de Graaf & Ben Allouch, 2013; Heerink et al., 2008; Hong et al., 2008).

5.5.1 Theoretical implications

Existing research in services marketing (Collier et al., 2014; Curran et al., 2005; Gelbrich & Sattler, 2014) highlights the need to understand the adoption of SSTs in a public service setting, and of service robots in particular (Bartneck & Forlizzi, 2004). The present study answers this call by empirically assessing antecedents (i.e., anthropomorphism) and outcomes (i.e., enjoyment and intention to use) of trust in a specific SST in a public service setting. The results have important implications for service marketing and research on human-machine interaction.

In particular, the present study sheds light on the contrasting perspectives that follow from the elicited agent knowledge mechanism and the sociality motivation mechanism in anthropomorphism theory (Epley et al., 2007). These two perspectives can be explained by literature on cognitive processing (Bodenhausen et al., 1994) and uncertainty reduction theory (Berger, 1986). First, this study provides evidence that when humans perceive interaction comfort as high, they tend to anthropomorphize robots with more human-like appearances. This finding can be explained by psychological research on cognitive processing that shows that when humans experience neutral to positive emotions, they process interaction cues less carefully and use more superficial or cursory styles of thinking, compared to humans who experience negative stress-related emotions such as discomfort (R. Baron et al., 1994; Bodenhausen et al., 1994). Therefore, humans who feel comfortable interacting with a service robot, might solely pay attention to superficial cues, such as appearance and not to behavioral cues such as gaze. Second, when customers experience low interaction comfort, our results seem to indicate that people anthropomorphize robots with human-like social functioning features more readily. This finding is in line with uncertainty reduction theory which stipulates that people pay greater attention to social functioning cues when they feel uncomfortable during the interaction.

Although research on human-machine often posits that all kinds of human-like features incite anthropomorphism (Fink, 2012), the current study supports the notion that moderating variables ultimately determine their effect. Thereby, this

study has validated the notion that individual characteristics, such as perceived interaction comfort, affect users' needs, which was proposed in chapter 3. Furthermore, by combining central concepts from literature on human-machine and emerging concepts from SST adoption literature (i.e., trust, interaction comfort and anthropomorphism), this study provides insight into users' adoption of service robots (Collier et al., 2014; Fan et al., 2016; Hancock et al., 2011; Kaushik & Rahman, 2015). As such, it contributes to the integrated research model called for in recent literature (Kaushik & Rahman, 2015; Wirtz et al., 2018).

Studies on human-machine that rely on both flow theory (El Shamy & Hassanein; Y. Lu et al., 2009) and technology acceptance (de Graaf & Ben Allouch, 2013; Heerink et al., 2008; Hong et al., 2008; Shin & Kim, 2008) establish enjoyment as an important predictor of intentions to use, yet research on its mediating role between trust and intentions to use service robots is scarce. The present study picks up on the notion that more trust is associated with higher enjoyment (Koufaris, 2002; K.C. Lee et al., 2007; Wu & Chang, 2005; Zhou et al., 2010) and conveys this point to marketing research.

5.5.2 Practical implications

Successfully integrating service robots in service interactions has the potential to benefit both service users and providers (Allmendinger & Lombreglia, 2005; Bitner, 2001; Meuter et al., 2000). Trust appears fundamental to the adoption of service robots in this setting and can be triggered by human-like cues that resemble humans in both appearance and social functioning. Which of these features is more effective, depends on the experienced interaction comfort of the user. Concretely, the findings of this study can help designers and managers reap these benefits and enhance public services settings.

First, for target groups for whom either the nature of the service (e.g., grocery service) or individual characteristics (e.g., experience) tend to make customers feel comfortable, equipping a robot with a human appearance will generally be more effective. Other adjustments could make the humanoid service robot appear more human-like, such as altering the service robot's facial features, eyebrows or cheeks (Walters et al., 2008). If, on the other hand, a service provider targets a group for whom either the nature of the service (e.g., medical service) or individual characteristics (e.g., social anxiety) tend to make users feel uncomfortable during the interaction, equipping a robot with social functioning features might be a more effective solution. For such target

groups, designers could experiment with other turn-taking cues, such as intonation, paralanguage, body motion, sociocentric sentences, pitch or syntax (Duncan, 1972).

Most humanoid service robots currently on the market resemble humans in appearance and not in social functioning (Fink, 2012), so managers might seek to engineer the physical surroundings of the service encounter to enhance people's interaction comfort and thereby create superior human-machine. Controllable factors that induce greater interaction comfort include general interior features (e.g., flooring, color schemes, lighting, music, scent, temperature, cleanliness), layout and design factors (e.g., furniture, space design and allocation) and decorations (e.g., wall decorations, signs) (Turley & Milliman, 2000).

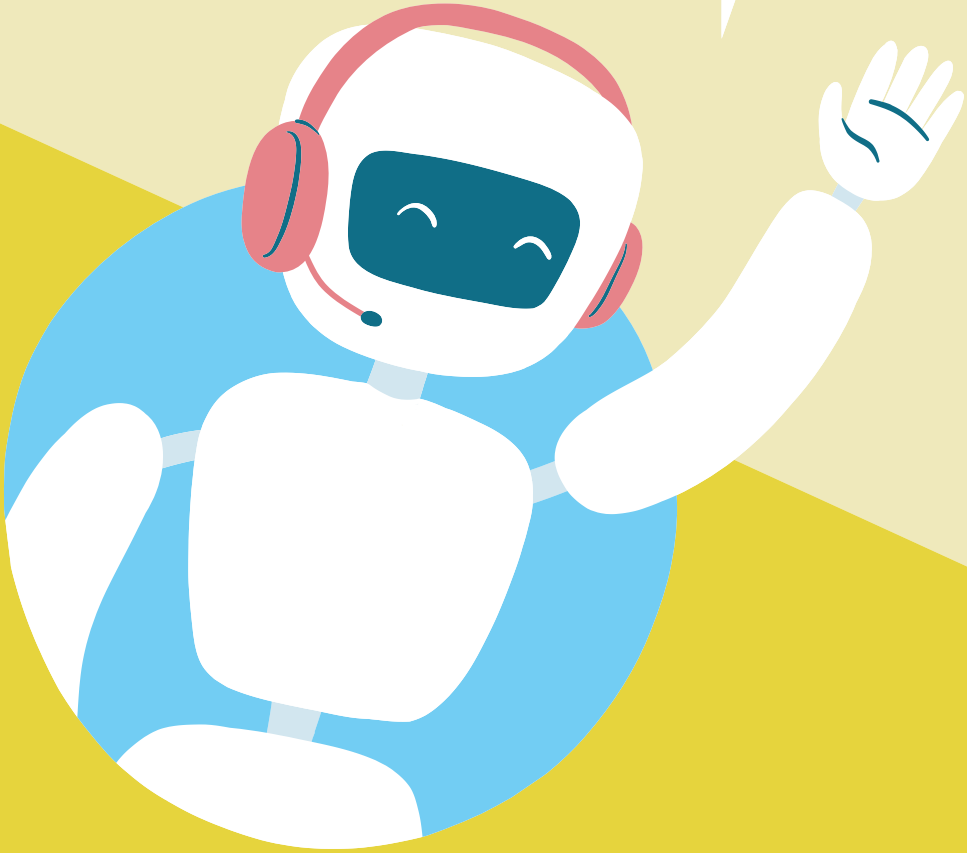
5.5.3 Limitations

Although the present study offers insights into several antecedents and outcomes of trust in service robots, it also has some limitations. First, the experiment was conducted in an open innovation campus in the south-eastern part of the Netherlands. This innovation campus represented a suitable service context but also meant that the sample was generally tech-savvy and accustomed to robotics (56% indicated prior experience in interacting with robots). Additional research could increase the generalizability of the findings by using a more diverse sample.

Second, participants' service encounters with the humanoid robot were relatively short in nature (M = 42.2 seconds), which might have precluded some participants from noticing or interpreting the gaze turn-taking cues. Longer interactions might make these cues, or other social functioning cues, more salient. Longer interactions in combination with the inclusion of other human-related moderators, such as an emotional state (Ho et al., 2008), represent promising avenues for further research.

Third, the results indicate that participants perceived the turn-taking cues used in this experiment as less human-like when they felt comfortable during the interaction. Although humans use gaze cues to clarify their turn-taking intentions (Duncan, 1972), they are unable to change the color of their eyes. Researchers in this field might attempt to combine robot-related and human-related factors to validate the relative importance of the elicited agent knowledge account or sociality motivation in Epley et al.'s (2007) anthropomorphism theory. One possibility is to study turn-taking cues that both humans and robots are able to perform in the same way, such as gestures or gazing (Chao & Thomas; Salem et al., 2013).

CHAPTER 6
FINAL THOUGHTS



6.1 Introduction

Service encounters between users and conversational agents are becoming increasingly prevalent in the service landscape (Huang & Rust, 2021; Larivière et al., 2017; Wirtz et al., 2018). With their ability to mimic human communicative behaviors, conversational agents distinguish themselves from other automation technologies (Laranjo et al., 2018; Seeger et al., 2017). Due to this ability, conversational agents are theorized to enhance relational outcomes (B.R. Duffy, 2003; Holtgraves et al., 2007). Yet, current literature shows that the effects of the use of human-like communicative behaviors (HCBs) by conversational agents are more complex (Brandtzaeg & Følstad, 2018; Clark et al., 2019; Stein & Ohler, 2017). Therefore, the general aim of this dissertation has been to investigate the conditions under which the use of HCBs by conversational agents enhance and deteriorate relational outcomes.

The studies described in chapters 2 to 5 were designed to address the three identified gaps and, ultimately, answer the overarching research question (see Figure 1). The remainder of this chapter is structured as follows: in section 6.2 we will relate the key findings of this dissertation to the identified gaps and will discuss recommendations for future research[5]. Thereafter, we will end section 6.2 by answering the overarching research question. Subsequently, in section 6.3 we will discuss theoretical and practical implications that go beyond those addressed in previous chapters. This chapter concludes with the limitations of this dissertation. These limitations notwithstanding, the most important implications for researchers as well as practitioners are described in more depth in the impact paragraph in the appendix.

[5] As the academic relevance, the practical relevance and methodology of each study were summarized in chapter 1, section 6.2 will focus on the key findings and recommendations for future research.

Figure 1 The gaps addressed in each chapter and the overarching research question

Overarching research question:
What are the effects of the use of HCBs by conversational agents on relational outcomes and how can these HCBs be implemented in service encounters considering users' individual needs and the service context?

Chapter	Title	Research gap	Research question
2	**Human-like communication in conversational agents:** a literature review and research agenda	As the literature is fragmented, there is no clear overview of HCBs that have already been studied and their effects on relational outcomes	Which communicative behaviors used by conversational agents have positive effects on relational outcomes and which additional behaviors or variables could be investigated in future research?
3	**Designing virtual service agents:** a creative approach for uncovering users' communicative needs	The effects of HCBs depend on the users' needs, the service context and the phase in the interaction, but the relationship between the three has not been systematically mapped before	What are users' needs for appearance characteristics and human-like communicative behaviors in conversational agents and how do these needs differ between service contexts and phases of the service interaction?
4	**The effects of communication style on relational outcomes in interactions between customers and conversational agents**	HCBs can be implemented in different ways, but few studies compare multiple implementations of the same HCB	What is the influence of the social-oriented communication style used by a conversational agent on the user's perceived social connection and is this effect more pronounced when such a communication style is implemented statically or adaptively?
5	**Trust in humanoid robots:** implications for services marketing		What is the influence of HCB type (appearance vs social function) on anthropomorphism and is this effect moderated by perceived interaction comfort?

6.2 Reflections on the research gaps

6.2.1 Gap 1: As the literature is fragmented, there is no clear overview of HCBs that have already been studied and their effects on relational outcomes.

Chapter 2 investigates gap 1 of the dissertation: 'As the literature is fragmented, there is no clear overview of HCBs that have already been studied and their effects on relational outcomes'. For that purpose, a systematic literature review was conducted that revealed a taxonomy with nine categories divided over two dimensions. The first dimension ('modality') classifies the nature of the communicative behavior(s) in each study and distinguishes three categories: verbal behaviors, nonverbal behaviors, and appearance characteristics. The second dimension ('footing') describes the grounds on which communicative behaviors

aim to establish relationships and distinguishes three categories: human similarity, individual similarity, and responsiveness.

Mapping the effects per category showed that although the literature provides a clear understanding of the effects of conversational agents' appearance, the effects of their verbal and nonverbal behaviors are mixed. More specifically, these effects appear to be moderated by users' needs, the service context, and the phases of the service interaction. However, it is unclear how these factors interact. In addition, several communicative behaviors that are effective in establishing relational outcomes in human-to-human service encounters have not yet been investigated in the context of conversational agents. The most promising ones are mimicry of language use or communication style, mimicry of gestures, posture, speech rate or facial expressions, the use of common grounding behaviors, the use of nonverbal expressions of empathy, and the use of back-channel responses that signal active listening.

Chapter 3 validates these findings by showing that users' preferences for the appearance characteristics of conversational agents do not differ much between individuals (see chapter 3, Figures 3a and 3b) and service contexts (see chapter 3, Figure 2). This finding indicates that the effects of human-like appearance characteristics in conversational agents are unequivocal. Furthermore, chapter 3 shows that users' preferences for verbal and nonverbal behaviors do differ between service contexts, and the phases of the service interaction (see chapter 3, Figures 4a, b and 5a, b), thereby indicating that these effects of these behaviors are more complex. Moreover, chapter 3 enriches this finding by showing where and how the service context and the phases of the service interaction affect users' needs.

Focusing on gap 1, we have a number of recommendations for future research. Although this dissertation has proposed factors that affect users' needs for the use of verbal and nonverbal behaviors by conversational agents, a comprehensive theoretical model, which explains these effects has yet to be designed and tested. Literature on human-machine interaction is often based on the CASA paradigm (Nass & Reeves, 2006) or anthropomorphism theory (Epley et al., 2007). While these theories provide a basic idea of the effects of HCBs, they could be extended. Therefore, we recommend researchers to focus on personal or situational factors that enhance or weaken anthropomorphism. For example, are HCBs anthropomorphized more readily in certain service contexts or during certain

phases of the service interactions and what are the mechanisms behind these effects?

6.2.2 Gap 2: We know that the effects of HCBs depend on the needs of the user, the service context and the phase in the interaction, but the relationship between the three has not been systematically mapped before.

Chapter 3 zooms in on the second gap of this dissertation; 'We know that the effects of HCBs depend on the needs of the user, the service context and the phase in the interaction, but the relationship between the three has not been systematically mapped before'. In order to identify users' communicative needs, a generative design study was conducted in which participants were actively involved in the design of a virtual service agent for a medical or financial context. To identify participants' tacit and latent needs, they were interviewed regarding their choices and underlying motivations. Coding of these interviews identified four needs users have regarding the appearance of VSAs (warmth, competence, conformity to social norms, identification) and five needs users have regarding the verbal and nonverbal behaviors (warmth, competence, validation, convenience, pleasant user experience).

In addition, this study compared users' preferences between the two service contexts, the stages of the service interaction, and individuals to see how these factors affect the identified needs. This comparison showed that users' needs for appearance characteristics of conversational agents are widely shared and therefore only need to be adapted in such a way that the user can identify with the conversational agent. However, users' needs for nonverbal and verbal behaviors were found to be strongly linked to the service context, the phases of the service interaction, and the idiosyncratic needs of the individual user. Specifically, users preferred more social-oriented verbal and nonverbal behaviors in the healthcare context, during the beginning and the end of the interaction, and when they felt that they needed validation. Therefore, these findings support the notion that users' needs for verbal and nonverbal are affected by these factors.

Yet, it is without a doubt that more factors impact the users' communicative needs. For example, research into human-to-human interaction has shown that factors such as culture, group membership, and affinity with technology have an

impact on users' communicative needs (Boyd & Pennebaker, 2017; Chattaraman et al., 2019; Kapoor et al., 2003). Researchers are recommended to delve deeper into these factors in future research. The generative design study presented in chapter 3 has proven to be a fruitful method to do so and can be easily repeated with participants with different cultural backgrounds, from different social groups, or with different levels of affinity with technology.

Finally, some participants in the generative design study presented in chapter 3 voiced a latent need for appearance characteristics and verbal and nonverbal communicative behaviors that were not encountered in the literature on conversational agents before, nor studied in this dissertation. Examples include conversational agents wearing a uniform, paraphrasing the user to indicate active listening or moving their eyes to express emotions. It is noteworthy to mention to almost all participants in this study viewed the eyes of a virtual service agent as very important and expressed a strong need for the agent to have 'kind eyes'. We strongly encourage researchers to explore the effects of these appearance characteristics and behaviors further.

6.2.3 Gap 3: HCBs can be implemented in different ways, but few studies compare multiple implementations of the same HCB.

Gap three; 'HCBs can be implemented in different ways, but few studies compare multiple implementations of the same HCB' is investigated in chapters 4 and 5. Previous chapters of this dissertation have shown that HCBs can lead to anthropomorphism which has a positive effect on relational outcomes, but the question remains how these HCBs should be implemented, taking into account users' needs. Therefore, chapters 4 and 5 aim two resolve two different implementation issues: 1) timing and 2) similarity to humans in appearance versus similarity to humans in social functioning.

First, in chapter 4 we tested an approach to meet the users' needs for social-oriented verbal communication. According to chapter 3, users' needs for social-oriented verbal communication are influenced by the stages of the service interaction and individual needs. However, it remains unclear whether it is more effective for conversational agents to adapt to users' needs statically (i.e., by displaying the same behavior all the time) or dynamically (i.e., by displaying different behaviors

throughout the course of the conversation). Therefore, an experimental study was conducted in which a travel agent was manipulated to respond using a static task-oriented, static social-oriented, or adaptive social-oriented communication style. In the adaptive social-oriented condition, the virtual agent only used a social-oriented communication style if the user chose a social-oriented reply in the previous turn. The results showed that an adaptive social-oriented communication style was most effective in enhancing both perceived engagement and rapport. Yet, the increase in engagement was mainly influenced by mimicking the user (the adaptive social-oriented communication style), while the increase in rapport was mainly influenced by the presence of social-communicative cues (the static social-oriented communication style). Therefore, this study provides evidence for the notion that utilizing mimicry can help to accommodate users' changing needs throughout the interaction.

Chapter 5 looks more closely at a different implementation question; anthropomorphism theory provides two contrasting perspectives on the type of HCBs that need to be implemented in conversational agents (Epley et al., 2007). First, the elicited agent knowledge perspective stipulates that conversational agents are anthropomorphized more readily when they possess observable human-like features and appearances. Second, the sociality motivation perspective proposes that conversational agents are anthropomorphized more readily when they possess features resembling humans' social functioning, like the possibility to display nonverbal communication cues. From a design perspective, this discrepancy raises interesting issues, because robots designed to mimic humans' social functioning do not necessarily resemble humans in appearance. To answer this question, an experimental field study was conducted with a humanoid service robot that either resembled humans in appearance by having a static eye color or in social functioning by using different eye colors to send turn-taking cues to the participants. The results showed that interaction comfort moderates the effect of turn-taking cues on anthropomorphism, such that turn-taking cues increase anthropomorphism when comfort is low and decrease it when comfort is high. In turn, anthropomorphism was found to drive trust, intention to use, and enjoyment. Therefore, this study provides evidence that when users feel uncomfortable, it pays off to implement HCBs that resemble humans in social functioning in conversational agents.

The results of these two studies show that if users' needs are met by choosing the right type of HCB (chapter 5) at the right time (chapter 4) this results in more positive relational outcomes. Yet, we recommend future researchers to further investigate how users' needs can be recognized during the interaction. Currently, conversational agents are not able to do that. Therefore, we encourage researchers in the field of human-machine interaction to investigate algorithms that go beyond intent recognition and can, for example, recognize users' communication style or level of comfort in written or spoken text. Furthermore, we encourage behavioral researchers to search for new ways to recognize users' needs in service interactions, as this dissertation provides evidence that they can enhance interactions with conversational agents significantly.

6.2.4 Overarching research question: what are the effects of the use of HCBs by conversational agents on relational outcomes and how can these HCBs be implemented in service encounters considering users' individual needs and the service context?

In the introductory chapter of this dissertation, I shared my childhood appreciation for Rosie and the resulting conviction that service providers looking to deploy conversational agents would do well to maximize the use of human-like communicative behaviors (HCBs) in their service design. Though I still stand by this statement, I think it deserves some nuance. Conversational agents are unique in their ability to mimic humans in both their appearance and verbal and nonverbal communicative behaviors. Due to this ability, they can enhance users' perceptions of relational mediators such as liking and trust, which in turn drive relational outcomes such as the intention to use conversational agents again. However, there must be a strong emphasis on 'can'. Conversational agents are not for all users. In addition, the users who do appreciate conversational agents do not all appreciate the use of HCBs by these agents in the same way. This finding particularly holds for the verbal and nonverbal communicative behaviors used by the conversational agent. While some may love a quirky, funny, social-oriented robot, others might hate it. Yet, this does not mean that the design of conversational agents should be based on trial and error. On the contrary, this dissertation has revealed various patterns in users' needs for HCBs in interactions with conversational agents, which will be outlined in the sections below.

6.3 Theoretical implications

By identifying conditions under which the use of HCBs by conversational agents affects relational mediators and outcomes, this dissertation provides theoretical contributions that deepen our understanding of human-machine interaction. First, we developed a taxonomy that will allow future researchers to investigate the effects of HCBs more systematically. Analyzing the effects of the HCBs in each category of this taxonomy has revealed mixed findings that deserve further research. In addition, the comparison of this taxonomy to the literature on human-to-human service encounters has provided a concrete research agenda with promising avenues for future research.

Second, users' latent needs for both human-like appearance characteristics and the use of verbal and nonverbal behaviors by conversational agents were derived from generative design interviews. These needs may help researchers explain mixed findings that were found in the literature. For example, the taxonomy revealed that verbal communicative behaviors grounded in responsiveness produced mixed effects. Many of the behaviors in this category, such as the use of empathy or affect support, are often used to validate problems users might have. Therefore, the mixed results might be explained by the finding that users' need for validation differs between service contexts and the different phases of the service interaction (see chapter 3).

Third, by investigating how conversational agents can enhance relational outcomes in service encounters, this dissertation answers the call for more theoretical knowledge on successful service automation that has been voiced in the field of services marketing (Larivière et al., 2017; van Doorn et al., 2017; Wirtz et al., 2018). In particular, the experiments presented in chapter 4 and 5 have combined important theories from the human-machine interaction literature, including anthropomorphism theory (Epley et al., 2007) and flow theory (Nakamura & Csikszentmihalyi, 2014), with the technology acceptance model (Gefen et al., 2003) from the field of marketing, as well as concepts and theories from psychology, such as communication accommodation theory (Giles, 2016) and mimicry (Dragojevic et al., 2016). Therefore, this dissertation contributes to more integrated research models that have been called for in recent literature (Kaushik and Rahman, 2015; Wirtz et al., 2018). Furthermore, this dissertation shines new light on the implementation of anthropomorphism theory (Epley et al., 2007).

Lastly, this dissertation offers methodological handles for researchers who are interested in the impact of conversational agents on services. The generative design study in chapter 3 provides a novel approach for researching users' needs by combining insights from research on creativity and human-centered approaches to design. Thereby, this dissertation might inspire others and addresses the need for more suitable methods to study user preferences regarding conversational agents (Larivière et al., 2017). In addition, the experimental studies presented in chapters 4 and 5 illustrate the value of experiments with conversational agents in real-life service settings. Although many conceptual papers on, human-machine interaction, social perception, and anthropomorphism have enriched the service literature the past few years, it is crucial to validate these theories and concepts by conducting experiments in real-life service settings.

6.4 Practical implications

The service environment is changing fundamentally due to rapid evolutions in technology (Larivière et al., 2017). While both service providers and users can benefit from the deployment of conversational agents in the service encounter, implementing them successfully provides a challenge for service managers and providers (Clark et al., 2019; Følstad, & Brandtzæg, 2017). Conversational agents' ability to mimic humans in appearance and verbal and nonverbal communicative behaviors does not only have positive effects but can also come at a cost, such as decreased task performance by the user (Salem et al., 2013), attention shifts (Pejsa et al., 2015) or the activation of undesirable personas (Powers et al., 2005). Therefore, service designers and managers are recommended to carefully design the appearance and communicative behaviors of their conversational agents. However, this is difficult as this knowledge is scattered over disciplines (Cowell and Stanney, 2005; van Doorn et al., 2017) and dependent on factors such as the service context (e.g., Keeling et al., 2010). Therefore, this dissertation provides an overview of the effects of the use of HCBs by conversational agents and users' communicative needs in interactions with conversational agents. Based on our results, service designers and providers are recommended to take into account the different phases in their service interactions, the service context, and specific needs that their users might have.

Specifically, chapters 3, 4, and 5 have yielded specific knowledge for service managers and providers on how to implement HCBs in conversational agents. Regarding the appearance of conversational agents, participants prefer human-like conversational agents with brown hair and brown eyes. Yet, participants do find it important that they can identify with the conversational agent, that the agent has a warm appearance, and that his or her appearance adheres to social norms. Preferences regarding the verbal and nonverbal behaviors of conversational agents are more complex. Service managers and providers are recommended to carefully research their user groups, their idiosyncratic needs, the context of their service, and the nature of their service interactions. Based on these factors service managers and providers should adjust the verbal and nonverbal behaviors of their conversational agents. If it is difficult to research these needs upfront, mimicry might provide a viable alternative approach.

6.5 Limitations

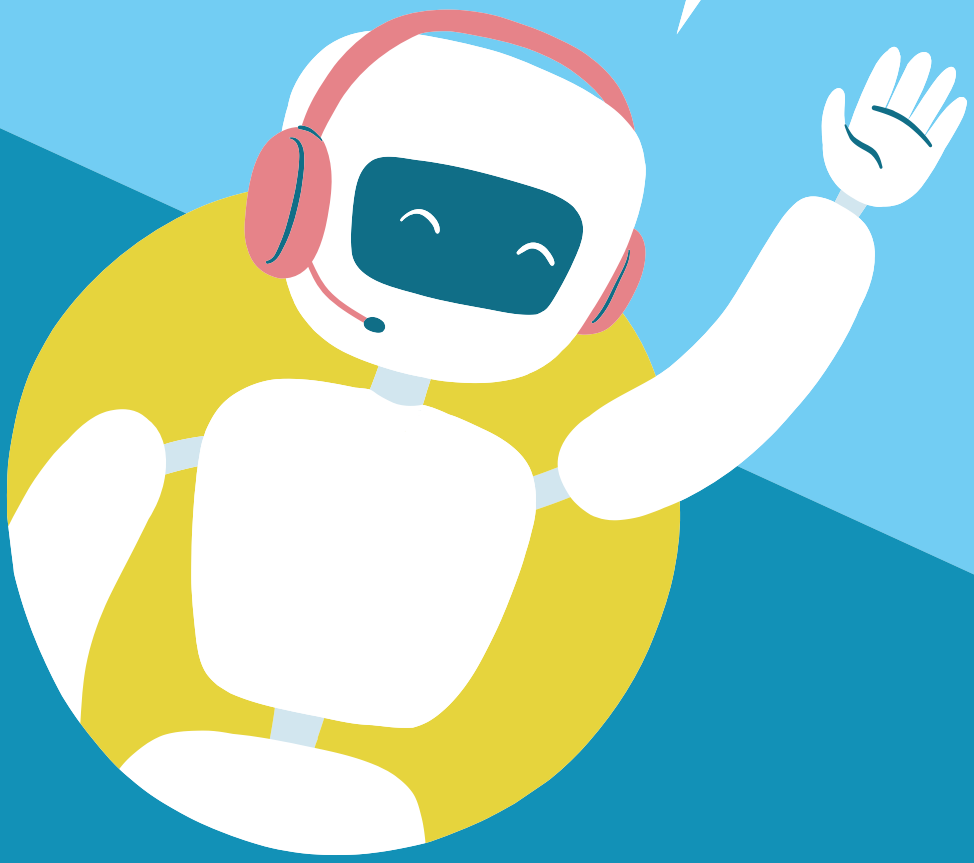
From a methodological point of view, several limitations should be pointed out. First, this dissertation concerns a research field that is in flux. Technological developments are moving faster than ever before, which implies that the practical state of the art might be already one step ahead.

Second, this dissertation combines research on chatbots, avatars, and robots under the common denominator of conversational agents. Although there is theoretical justification to do so, this may have oversimplified the differences between different agent types. For example, the effects of communicative behaviors tested in a robot cannot be seen in the absence of its physical embodiment. Therefore, it is hard to compare the effects of similar communicative behaviors between different types of conversational agents. Similarly, in the reasoning of this dissertation, different relational mediators such as trust, and engagement are gathered under the common denominator of relational mediators. Using this common denominator might have oversimplified the differences in the effects of these different relational mediators. This is illustrated by chapter 4 in which the effect of communication style on both engagement and rapport is investigated. The results of the study show, that both engagement and rapport are affected distinctively by communication style. Thus, although HCBs can enhance relational mediators and outcomes through anthropomorphism, research should be mindful of varying effects on these relational mediators and outcomes.

A third limitation concerns the measurement of the relational mediators. In the experiments described in chapters 4 and 5, we relied on self-reported measures of trust and the perceived social connection. In these studies, participants were asked to report on these concepts shortly after exposure to the manipulation. Yet, as these relational mediators constitute feelings of short duration and service encounters are dynamic, researchers are advised to enrich these self-reported measures with other types of measurement, for example, eye-tracking or movements, or biological measurements, such as EEG signals or skin conductance measurements.

A final limitation of this dissertation is the generalizability of the findings. For the studies in chapters 3, 4, and 5, an attempt was made to recruit diverse and representative samples of participants. The demographics of the samples in these chapters show, however, that on average the participants were in their twenties and relatively well-educated. Furthermore, participants in all studies were of Dutch descent. This bias may have had an effect on our findings. More specifically, it is conceivable that the inclusion of more diverse samples would have resulted in the identification of a greater variety of users' needs. Therefore, future research should aim to include samples with a greater variety in demographics. These limitations notwithstanding, the most important implications for researchers as well as practitioners are described in more depth in the impact paragraph in the appendix.

APPENDIX



Impact paragraph

In the past decade, the deployment of conversational agents (chatbots, avatars, robots) has become increasingly prevalent. As discussed in depth in chapter 1, improved capabilities to respond to users, driven by advances in artificial intelligence and, in particular, natural language processing, have enabled their use in various service contexts. Their unique ability to mimic human communicative behaviors (HCBs) can provide benefits for users and service providers, yet knowledge on how to use this ability effectively is still lacking. Although anthropomorphism theory and the CASA paradigm have provided a basic understanding of how relational variables such as trust and liking can be affected by conversational agents' use of human-like communicative behaviors, the reality is more complex. Therefore, this dissertation aimed to investigate the effects of the use of HCBs by conversational agents on relational outcomes and how these HCBs can be implemented into service encounters considering users' individual needs and the service context.

The results of this dissertation support the notion that a one-size-fits-all approach for the implementation of HCBs in conversational agents does not exist. Both the literature review (chapter 2) and the generative design study (chapter 3) show that users largely agree on how conversational agents should look. Users need to be able to identify with a conversational agent and find it important that a conversational agent has a warm appearance that conforms to certain social norms. However, users' needs concerning conversational agents' verbal and nonverbal behaviors are more idiosyncratic. In particular, users express different preferences for the frequency, timing, and applicability of social-oriented verbal (e.g., empathy, small talk) and nonverbal behaviors (e.g., nodding, emotional expressions). These needs seem to vary as a function of the service context, the phase of the service interaction, and individual users' needs, such as experiencing discomfort. The experiment in chapter 4 showed that it is best to implement such behaviors in a way that they are adaptive to the user in every turn of the interaction. Finally, the experiment in chapter 5 validated that social-oriented nonverbal behaviors are particularly important when the user experiences discomfort.

For researchers, these findings highlight the impact of users' needs and factors that drive these needs (e.g., the service context and the different stages of the service interaction). As such, this dissertation has provided input for a broader

theoretical framework that might explain the mixed effects in the current literature on conversational agents. We want to encourage researchers to investigate technologies that allow conversational agents to recognize users' needs in real-time and adapt their communicative behavior to the dynamics of the service interaction and individual user characteristics. Furthermore, we hope that particularly the generative design study (chapter 3) will inspire other researchers to investigate users' latent needs for human-like communicative behaviors in conversational agents in a broader set of service contexts and with more variation in users.

For service designers and managers, this dissertation offers a blueprint for improving service interactions involving conversational agents. In particular, we describe users' latent needs for both appearance and verbal and nonverbal behaviors of conversational agents. More importantly, we recommend practitioners to carefully investigate the individual needs of their users, the structure of their service interactions, and other context-related factors that could impact users' needs. Yet, this dissertation does not only provide a blueprint for service designers and managers but is also applicable in other contexts. Due to the rapid technological developments and the COVID-19 pandemic, the use of conversational agents has found new applications. For example, avatars or virtual agents are increasingly used as 'virtual influencers', marketing products and services to millions of followers. In addition, conversational agents are becoming more prevalent in domains such as mental health, coaching, and motivating patients, where the ability to build relationships with users is perhaps even more important than in many 'standard' service contexts. Incorporating the findings of this dissertation into the design of these conversational agents can therefore be expected to bring considerable societal benefits.

To conclude, by highlighting the importance of users' communicative needs and factors influencing these needs, we hope to contribute to the development of sustainable services in many different domains. Conversational agents can provide benefits for both users and service providers, yet, only if they are designed explicitly for and by users. We are confident that the rapid technological developments will further enhance conversational agents' capabilities and home to motivate others to investigate how the quality of human-machine interactions can be enhanced further.

Dutch summary (samenvatting)

In de afgelopen jaren hebben technologische ontwikkelingen de aard van dienstverlening ingrijpend veranderd (Huang & Rust, 2018). Technologie wordt steeds vaker ingezet om menselijke servicemedewerkers te vervangen of te ondersteunen (Larivière et al., 2017; Wirtz et al., 2018). Dit stelt dienstverleners in staat om meer klanten te bedienen met minder werknemers, waardoor de operationele efficiëntie toeneemt (Beatson et al., 2007). Deze operationele efficiëntie leidt weer tot lagere kosten en een groter concurrentievermogen. Ook voor klanten kan de inzet van technologie voordelen hebben, zoals betere toegankelijkheid en consistentie, tijd- en kostenbesparing en (de perceptie van) meer controle over het serviceproces (Curran & Meuter, 2005). Mede vanwege deze beoogde voordelen is de inzet van technologie in service-interacties de afgelopen twee decennia exponentieel gegroeid.

De inzet van zogenaamde conversational agents is een van de belangrijkste manieren waarop dienstverleners technologie kunnen inzetten om menselijke servicemedewerkers te ondersteunen of vervangen (Gartner, 2021). Conversational agents zijn geautomatiseerde gesprekspartners die menselijk communicatief gedrag nabootsen (Laranjo et al., 2018; Schuetzler et al., 2018). Er bestaan grofweg drie soorten conversational agents: chatbots, avatars, en robots. Chatbots zijn applicaties die geen virtuele of fysieke belichaming hebben en voornamelijk communiceren via gesproken of geschreven verbale communicatie (Araujo, 2018; Dale, 2016). Avatars hebben een virtuele belichaming, waardoor ze ook non-verbale signalen kunnen gebruiken om te communiceren, zoals glimlachen en knikken (Cassell, 2000). Robots, ten slotte, hebben een fysieke belichaming, waardoor ze ook fysiek contact kunnen hebben met gebruikers (Fink, 2012). Conversational agents onderscheiden zich door hun vermogen om menselijk gedrag te vertonen in service-interacties, maar op de vraag ‘hoe menselijk is wenselijk?’ bestaat nog geen eenduidig antwoord.

Conversational agents als sociale actoren

Om succesvol te zijn als dienstverlener, is kwalitatief hoogwaardige interactie tussen servicemedewerkers en klanten van cruciaal belang (Palmatier et al., 2006). Dit komt omdat klanten hun percepties van een servicemedewerker (bijv. vriendelijkheid, bekwaamheid) ontlenen aan diens uiterlijk en verbale en non-

verbale gedrag (Nickson et al., 2005; Specht et al., 2007; Sundaram & Webster, 2000). Deze klantpercepties beïnvloeden belangrijke aspecten van de relatie tussen klanten en dienstverleners, zoals vertrouwen en betrokkenheid, die op hun beurt intentie tot gebruik, mond-tot-mondreclame, loyaliteit en samenwerking beïnvloeden (Hennig-Thurau, 2004; Palmatier et al., 2006).

Er is groeiend bewijs dat de uiterlijke kenmerken en communicatieve gedragingen (hierna: menselijke communicatieve gedragingen) die percepties van klanten positief beïnvloeden, ook effectief zijn wanneer ze worden toegepast door conversational agents (B.R. Duffy, 2003; Holtgraves et al., 2007). Het zogenaamde 'Computers Als Sociale Actoren' (CASA paradigma vertrekt vanuit de aanname dat mensen de neiging hebben om onbewust sociale regels en gedragingen toe te passen in interacties met computers, ondanks het feit dat ze weten dat deze computers levenloos zijn (Nass et al., 1994). Dit kan verder worden verklaard door het fenomeen antropomorfisme (Epley et al., 2007; Novak & Hoffman, 2019). Antropomorfisme houdt in dat de aanwezigheid van mensachtige kenmerken of gedragingen in niet-menselijke agenten, onbewust cognitieve schema's voor menselijke interactie activeert (Aggarwal & McGill, 2007; M.K. Lee et al., 2010). Door computers te antropomorfiseren komen mensen tegemoet aan hun eigen behoefte aan sociale verbinding en begrip van de sociale omgeving (Epley et al., 2007; Waytz et al., 2010). Dit heeft echter ook tot gevolg dat mensen cognitieve schema's voor sociale perceptie toepassen op conversational agents.

Doel van dit proefschrift

Samen met de theorie rondom antropomorfisme heeft het CASA paradigma de ontwikkeling aangewakkerd van conversational agents die menselijke communicatief gedrag vertonen (Fink, 2012). Voorbeelden zijn chatbots die complimenten geven (Kaptein et al., 2011), avatars die hoofd- en rompbewegingen nabootsen (Hale en Hamilton, 2016) en knikkende robots (Broadbent et al., 2013). De toevoeging van deze menselijke communicatieve gedragingen heeft echter niet altijd een positief effect op de percepties van de gebruiker. Dit heeft tot gevolg dat conversational agents er niet altijd in slagen een relatie met de gebruiker op te bouwen (Everett et al., 2017; B. Morgan, 2017; Polani, 2017). Om beter te begrijpen hoe menselijk communicatief gedrag in conversational agents een positief effect kan hebben op de perceptie van gebruikers, is er kennis nodig op drie vlakken.

Ten eerste is de literatuur over conversational agents sterk gefragmenteerd, waardoor we niet goed weten welke menselijke communicatieve gedragingen al zijn onderzocht en tot welke effecten ze leiden (Cowell & Stanney, 2005; van Doorn et al., 2017). Ten tweede weten we dat de effecten van het gebruik van menselijke communicatieve gedragingen door conversational agents afhankelijk zijn van de behoeften van de gebruiker, de servicecontext en de fase in de interactie, maar is de relatie tussen die drie nog niet eerder systematisch in kaart gebracht. Tot slot kunnen menselijke communicatieve gedragingen op verschillende manieren worden geïmplementeerd, bijvoorbeeld in termen van frequentie, timing of verschijningsvorm, maar zijn er maar weinig studies die meerdere implementaties van dezelfde communicatieve gedragingen met elkaar vergelijken. Dit proefschrift heeft als doel deze drie kennislacunes op te vullen.

Opbouw van het proefschrift

Dit proefschrift bestaat uit een introductiehoofdstuk, vier empirische hoofdstukken die de eerdergenoemde kennislacunes proberen op te vullen en een afsluitend hoofdstuk waarin de belangrijkste bevingen en hun maatschappelijke en theoretische implicaties worden bediscussieerd en aanbevelingen worden gedaan voor toekomstig onderzoek.

Hoofdstuk 2: Menselijke communicatie in conversational agents: een literatuuronderzoek en onderzoeksagenda

Hoofdstuk 2 behandelt de eerste lacune. De onderzoeksvraag is de volgende: ‘welke menselijke communicatieve gedragingen die door conversational agents worden gebruikt, hebben positieve effecten op relationele variabelen en uitkomsten en welke gedragingen uit de marketingliteratuur over menselijke servicemedewerkers moeten in de toekomst worden onderzocht?’ Om deze vraag te beantwoorden is een systematisch literatuuronderzoek uitgevoerd, waarbij 61 wetenschappelijke artikelen zijn geanalyseerd over de effecten van het gebruik van menselijke communicatieve gedragingen door conversational agents op relationele variabelen. Door de onderzochte communicatieve gedragingen in ieder artikel open en axiaal te coderen, vonden we een taxonomie met negen categorieën verdeeld over twee dimensies. De eerste dimensie, modaliteit, classificeert de aard van het communicatieve gedrag in elk onderzoek en onderscheidt drie

categorieën: verbaal gedrag, non-verbaal gedrag en uiterlijke kenmerken. De tweede dimensie, footing, beschrijft de gronden waarop de communicatieve gedragingen een invloed hebben op relationele variabelen en onderscheidt drie categorieën: gelijkenis met mensen in het algemeen, gelijkenis met individuele gebruikers en responsiviteit. Door de effecten per categorie in kaart te brengen, is gebleken dat de literatuur een duidelijk beeld geeft van de effecten van menselijke uiterlijke kenmerken in conversational agents. De effecten van het gebruik van verbale en non-verbale gedragingen zijn daarentegen minder duidelijk. De effecten van deze gedragingen lijken afhankelijk van gebruikersbehoeften, die kunnen variëren als gevolg van individuele verschillen, de servicecontext en het stadium van de service-interactie. Bovendien zijn verschillende communicatieve gedragingen die effectief zijn gebleken in service-interacties met menselijke medewerkers nog niet onderzocht in de context van conversational agents. De meest veelbelovende zijn: het nabootsen van taalgebruik of communicatiestijl, het nabootsen van gebaren, houding, spreeksnelheid of gezichtsuitdrukkingen, het benoemen van overeenkomsten met de gebruiker, het gebruik van non-verbale uitingen van empathie en toepassen van actief luistergedrag.

Hoofdstuk 3: Hoe ontwerp je een conversational agent: een creatieve techniek om de communicatieve behoeften van gebruikers te onderzoeken.

Hoofdstuk 3 zoomt in op de tweede kennislacune. De onderzoeksvraag is de volgende: 'hoe verschilt de behoefte aan het gebruik van menselijk communicatieve gedragingen door een conversational agent tussen gebruikers, servicecontexten en stadia van de service-interactie?' Hoofdstuk 2 heeft aangetoond dat voldoen aan de communicatieve behoeften van de gebruiker belangrijk is voor het succes van conversational agents. Daarom is het doel van dit hoofdstuk om deze behoeften in kaart te brengen. Daartoe is een onderzoek uitgevoerd volgens de principes van 'generative design', waarbij deelnemers actief betrokken waren bij het ontwerpen van een virtuele servicemedewerker voor een medische of financiële context. Om inzicht te krijgen in hun voorkeuren, doorliepen de deelnemers vier fasen; 1) sensibilisering ten aanzien van het onderwerp, 2) ontwerp van het uiterlijk van de agent met behulp van een gezichtsgenerator, 3) ontwerp van de verbale en non-verbale communicatie van de medewerker met behulp van verhaallijnen en spelkaarten, en 4) een vragenlijst naar achtergrondkenmerken van de deelnemer.

Om nader inzicht te krijgen in de latente behoeften achter deze voorkeuren, werden de deelnemers geïnterviewd over hun keuzes en onderliggende motivaties.

Voor de uiterlijke kenmerken van conversational agents heeft deze studie vier gebruikersbehoeften gevonden (warmte, competentie, conformering aan sociale normen en identificatie). Voor de verbale en non-verbale gedragingen zijn dat er vijf (warmte, competentie, validatie, gemak, prettige gebruikservaring). Verder blijkt uit de resultaten dat gebruikersbehoeften voor uiterlijke kenmerken weinig variatie vertonen, zolang de gebruiker zich maar kan identificeren met de agent. De gebruikersbehoeften voor non-verbale en verbale gedragingen zijn echter wel sterk gebonden aan de fase in het gesprek, de servicecontext en de idiosyncratische behoeften van individuele gebruikers. Gebruikers willen meer sociaal verbaal en non-verbaal gedrag in de medische context, aan het begin en aan het einde van de interactie, en wanneer ze behoefte hebben aan validatie. Bovendien waren er geen deelnemers die geen enkele vorm van sociaal communicatief gedrag wensten, of dat wensten bij elke beurt. Tot slot roept dit onderzoek vragen op over de implementatie van deze uiterlijke kenmerken en gedragingen die aan bod komen in de volgende twee hoofdstukken.

Hoofdstuk 4: De effecten van communicatiestijl op relationele uitkomsten in interacties tussen klanten en conversational agents.

Hoofdstuk 4 gaat verder in op de derde kennislacune door te onderzoeken hoe menselijke communicatieve gedragingen het effectiefst kunnen worden geïmplementeerd in conversational agents. De specifieke onderzoeksvraag die in dit hoofdstuk centraal staat is: ‘zijn gesprekspartners die een sociaal-georiënteerde communicatiestijl gebruiken beter in het creëren van een sociale connectie met de gebruiker en zo ja, moeten ze die sociaal-georiënteerde communicatiestijl op een statische of adaptieve manier implementeren?’ Hoofdstuk 3 heeft laten zien dat met name de behoefte aan het gebruik van verbale en non-verbale gedragingen door conversational agents sterk variëren tijdens de service-interactie. Toch is er in de literatuur onduidelijkheid over hoe om te gaan met de dynamische aard van gebruikersbehoeften. Om dit te onderzoeken is een experimenteel onderzoek uitgevoerd met een virtuele reisagent die werd gemanipuleerd om te reageren in een statisch taak-georiënteerde, statische sociaal-georiënteerde of een adaptieve sociaal-georiënteerde communicatiestijl. In de adaptieve

sociaal-georiënteerde conditie gebruikte de virtuele agent alleen een sociaal-georiënteerde communicatiestijl als de gebruiker in de vorige beurt een sociaal-georiënteerd antwoord koos; in de twee statische condities gebruikte de virtuele agent altijd dezelfde communicatiestijl (taak- of sociaal-georiënteerd). De resultaten laten zien dat zowel de ervaren sociale connectie en de betrokkenheid van de gebruiker het hoogst zijn wanneer de conversational agent een sociaal-georiënteerde communicatiestijl gebruikt. Daarbij wordt de betrokkenheid vooral beïnvloed door de aanpassing aan de gebruiker (adaptieve sociaal-georiënteerde communicatiestijl), terwijl de sociale connectie vooral wordt beïnvloed door de aanwezigheid van sociale elementen in de communicatiestijl (statische sociaal-georiënteerde communicatiestijl). Daarmee laat deze studie zien dat tegemoetkomen aan de dynamische behoeften van gebruikers in verschillende fases van de interactie helpt om een sociale band met die gebruiker tot stand te brengen.

Hoofdstuk 5: Vertrouwen in humanoïde robots: implicaties voor services marketing.

Ten slotte wordt in hoofdstuk vijf aandacht aan een ander aspect van implementatie (de derde kennislacune). De onderzoeksvraag is de volgende: ‘welke robotkenmerken (uiterlijk versus sociaal functioneren) beïnvloeden het antropomorfisme het meest?’. Hoofdstuk 3 schetst dat de behoefte van gebruikers aan het gebruik van menselijke communicatieve gedragingen door conversational agents kan variëren. Dit wordt ondersteund door de antropomorfisme-theorie (Epley et al., 2007), maar die is dubbelzinnig over de meest effectieve implementatie van deze communicatieve gedragingen. Daarom is een experimenteel veldonderzoek uitgevoerd met een humanoïde dienstrobot die in de ene conditie zijn oogkleur veranderde om beurtwisselingen te markeren (een zogenaamde gaze cue), en dat in de andere conditie niet deed. Daardoor leek hij in de eerste conditie op mensen qua sociaal functioneren, maar minder qua uiterlijk, terwijl dat in de tweede conditie precies andersom was. De resultaten toonden aan dat interactiecomfort het effect van gaze cues op antropomorfisme afzwakt, in die zin dat gaze cues antropomorfisme verhogen wanneer de gebruiker weinig comfort ervaart en antropomorfisme verminderen wanneer de gebruiker veel comfort ervaart. Daarnaast laat de studie zien dat antropomorfisme een positief effect heeft op vertrouwen, intentie om de servicerobot nog een keer te gebruiken

en het ervaren plezier van de gebruiker. Net als de studie die is gepresenteerd in hoofdstuk 4 laat ook deze studie zien dat het belangrijk is om de behoeften van de gebruiker mee te nemen in het ontwerp van een conversational agent.

Hoofdstuk 6 - Discussie

Dit proefschrift sluit af met een hoofdstuk waarin de belangrijkste bevingen en hun maatschappelijke en theoretische implicaties worden besproken en aanbevelingen worden gedaan voor toekomstig onderzoek.

Allereerst is in hoofdstuk 2 gesteld dat de literatuur over conversational agents sterk gefragmenteerd is, waardoor we niet goed weten welke menselijke communicatieve gedragingen als zijn onderzocht en tot welke effecten ze leiden. Dit proefschrift heeft laten zien dat het mogelijk is om een systematische taxonomie van deze literatuur te maken. Wanneer we verder inzoomen op die taxonomie, kunnen we concluderen dat de literatuur een duidelijk beeld schetst van hoe menselijk conversational agents eruit moeten zien, maar er een minder eenduidig beeld schetst over de mate waarin conversational agents zich verbaal en non-verbaal als mens moeten gedragen. Daarnaast kunnen we concluderen dat sommige uiterlijke kenmerken en communicatieve gedragingen nog helemaal niet onderzocht zijn in de context van conversational agents.

Ten tweede stelt hoofdstuk 2 dat we weten dat de effecten van het gebruik van menselijke communicatieve gedragingen door conversational agents afhankelijk zijn van de behoeften van de gebruiker, de servicecontext en de fase in de interactie, maar dat de relatie tussen die drie nog niet eerder systematisch in kaart is gebracht. Dit proefschrift heeft in hoofdstuk 3 laten zien dat die behoeften van gebruikers vooral verschillen voor de verbale en non-verbale gedragingen van conversational agents. Daarnaast worden de behoeften van gebruikers sterk beïnvloed door hun eigen individuele eigenschappen, de servicecontext en de fase van de interactie. Deze bevindingen worden verder bevestigd in hoofdstuk 4 en 5.

Tot slot stelt hoofdstuk 2 dat communicatieve gedragingen op verschillende manieren kunnen worden geïmplementeerd, bijvoorbeeld in termen van frequentie, timing of verschijningsvorm, maar dat er maar weinig studies zijn die meerdere implementaties van dezelfde communicatieve gedragingen met elkaar vergelijken. Dit proefschrift laat in hoofdstuk 4 en 5 zien dat de manier waarop

die communicatieve gedragingen worden geïmplementeerd van invloed is op verschillende relationele variabelen. Hoofdstuk 4 laat zien dat het gebruik van menselijke communicatief gedrag door conversational agents adaptief moet zijn aan de steeds veranderende behoefte van de gebruiker gedurende de service-interactie. Daarnaast laat hoofdstuk 5 zien dat ook de mate van comfort die de gebruiker ervaart een rol speelt in bij de optimale implementatie van menselijke communicatieve gedragingen. Deze bevindingen kunnen servicemanagers en designers helpen om conversational agents succesvol te implementeren in hun dienstverlening. Toekomstig onderzoek zou moeten onderzoeken hoe de communicatieve behoeften van de gebruiker tijdens het gesprek achterhaald kunnen worden en in real-time geïmplementeerd kunnen worden in het design van conversational agents.

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Note: References preceded by an asterisk were included in the literature review presented in chapter 2

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In this dissertation, I have argued that humans can be replaced by conversational agents, but I believe this statement needs some qualification. Although conversational agents can act as powerful agents of social connection, they will never be able to be as loving, caring, and creative as humans are[6]. Therefore, we all have some humans in our lives that are irreplaceable. I would like to acknowledge those who have been irreplaceable for me during this journey.

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[6] If you are interested in reading more about what it means to be human and alive, I can recommend: Christian, B. (2011). *The most human human: What talking with computers teaches us about what it means to be alive*. Anchor. Ishiguro, K. (2021). *Klara and the Sun*. Knopf.

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About the author

Michelle Maria Elisabeth van Pinxteren was born on March 8, 1992, in Tilburg, the Netherlands. In 2013 she received her bachelor's degree in Communication Science at Radboud University, Nijmegen, the Netherlands. During her bachelor studies, she was involved as a research assistant in several research projects at the Department of Communication Science, which sparked her passion for research. After her bachelor studies, she continued her education at Radboud University with a two-year research master's degree at the Behavioral Science Institute, which she successfully completed in 2015. In 2016 Michelle started working at Zuyd University of Applied Sciences as a lecturer within the Bachelor programs of the School of European Studies and the Academy of Oriental Languages and Communication. In this position, she was involved in teaching statistics, research methods, and communication and marketing and she started working on her PhD project on conversational agents of which this dissertation is the final product. Her PhD project focuses on the effects of the use of human-like communicative behaviors by conversational agents on relational outcomes in services. All four manuscripts of her dissertation have been presented at national and international conferences, such as Frontiers in Service and Interpersonal Communication and Social Interaction (ICSI). At present, Michelle is appointed as Assistant Professor of Communication Science at the Communication Science department of Radboud University.