Machines as Partners

Anthropomorphism and Communication Accommodation to Voice Assistants in Disability Contexts

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Abstract *This chapter introduces a theoretical approach for the analysis of verbal interaction between humans and machines, and demonstrates its application in a specific social situation. Based on the well-established sociolinguistic model, Communication Accommodation Theory (CAT), we introduce the "CAT Technology Equivalence Model", which helps to identify specific convergence and divergence strategies in verbal communication with machines. Conceptualizing VAs as social actors, a qualitative study was carried out with four households with VAs used by people with care needs. The participants documented their activities with the VAs in media journals and commented on their communication strategies in semi-structured interviews. The aim of the study was to demonstrate implicit and explicit ways of communicative accommodation towards voice assistants in order to better understand how verbal AI systems are anthropomorphized in everyday interactions. Results demonstrate that participants consciously and/or unconsciously adjust their linguistic behavior to accommodate their anthropomorphic framing of Alexa and accommodate it to the perceived logics of the technology. The chapter concludes that, as technology adopts ever more human-like qualities including physical form and voice, the question of 'human-likeness' in shaping speech behaviors will become an even more significant area of study.*

1. Introduction

In millions of homes, voice assistants (VAs) have become the technology of choice for orchestrating an impressive variety of everyday tasks. Operating in response to voice commands, the devices can manage smart home appliances, provide traffic and weather updates, and perform many other duties according

to individualized personal preferences. As such, smart speakers represent a form of machine technology that has facilitated widespread access to personalized technological functionalities in the home, with some researchers even calling them "game changers" (Vlahos 2019, 3). Authors argue that the pervasive integration of these assistants has fundamentally transformed our interactions within the home environment and has opened up AI-controlled technology for mass usage. At the same time, smart speakers are seen as a security risk and a threat to privacy. Various scandals involving Amazon employees listening via Alexa to household conversations as they take place in real time have stoked such fears and led to a lack of trust, particularly in data-conscious countries like Germany. In dealing with the tension between the desire for convenience and the unease of mistrust, anthropomorphizing tendencies have been observed, especially among younger individuals. Alexa herself is absolved of responsibility for the alleged privacy breaches ("It is not her fault", Fetterolf and Hertog 2023, 7). This is just one example of how smart speakers attract academic interest not only for their pragmatic utility but also for their capacity to critically reshape the dynamics of communication between humans and machines.

With this broader perspective in mind, our chapter aims to explore a specific aspect of interaction between humans and voice assistants*: types of communicative social interaction* in which individual interlocutors regard the machine as a *social actor* (Lombard and Xu 2021, 29). Building upon the premise that technologies are becoming increasingly 'intelligent' in the sense that they are perceived to be gaining increasingly human-like capacities across various domains including general agency, verbal interaction, and emotion recognition, as well as offering an expanding array of services, we examine selected communication strategies in order to systematically analyze human–machine relationships. For this purpose, we develop a model based on *communication accommodation theory* (*CAT*). The model provides a framework for integrating social cues and the social situations within which interactions take place into the analysis of human–VA (or other machines) communication. Furthermore, we propose that the notion of 'anthropomorphism' is a key element that can aid our analysis of human–machine communication. As we elaborate below, we understand anthropomorphism as a *bridging principle* that elucidates the various strategies employed by humans to adapt to the distinctive attributes and uncertainties inherent to communication with machines.

In order to apply this theoretical work to a specific social situation, we chose a setting in which a user's relationship with their VA is not simply

supplementary or playful, but characterized by a certain degree of dependency. This social scenario pertains to individuals with disabilities, who face challenges associated with limited control over certain functionalities and diminished personal autonomy. Among the various technological solutions deployed to support individuals with disabilities or cognitive impairments, off-the-shelf conversational agents or voice assistant systems like Amazon's Alexa play an important role in increasing personal autonomy by supporting the management of everyday domestic life (Purington et al. 2017, 2858; Kramer et al. 2013, 1105; Albert et al. 2013, 19). To understand how people with disabilities incorporate VAs into their homes and routines and how they regard their communicative relations with those machines, we carried out a qualitative study in four households that were home to four participants with special needs ('test persons') who used VAs in their homes. Two caregivers from two of the households also took part in the study (B2 and D2).

Table 1: Participants and households

Household	Age	Gender	Care needs	Alexa (quantity)
A	25	Female	Yes	3
B1	58	Female	Yes	1
B2	57	Male	No	
C	51	Male	Yes	1
D1	23	Male	Yes	1
D2	54	Male	No	

The participants documented their user experience in media journals and also reflected upon their perceptions and attitudes towards VAs in semi-structured interviews before and after the journaling period. Our aim with this chapter is to illustrate that the ways these participants communicate with the machines demonstrate typical accommodation strategies on a technical and a personal level. Before doing so, we present the theoretical basis of our investigation by briefly outlining the role of anthropomorphic ascriptions and attributions and introducing 'communication accommodation theory' (CAT).

2. Machines as Partners: Computers as Social Actors

As the development of artificial intelligence advances unabated, ever more diverse possibilities for transforming relationships between humans and technology are being highlighted (Thimm 2019, 17). Social robots for care contexts (Henschel et al. 2021, 14), generative language programs (Large Language Models or LLMs) like ChatGPT, and interactive voice assistant systems (such as Alexa or Siri) simulate 'authentic' interpersonal interactions, mimic cognitive processes of emotion recognition, and some even present themselves in humanoid physical forms. With the continuously expanding functional spectrum of artificial intelligence, new scenarios are being addressed and AI systems are operating in ever more social contexts in diverse roles, from a simple executive tool to a more complex 'social companion'. The idea of the so-called 'social robot' in particular has attracted wide attention in recent years (Mahdi et al. 2022, 1; Thimm and Thimm-Braun 2024).

Since 1996, the idea of the social machine has been discussed under the *Computers are Social Actors* (CASA) paradigm (Nass et al. 1994, 72). Machines are no longer perceived within communication processes as media for merely storing, visualizing, and/or distributing information, but are designed, utilized, and studied as communication partners (Guzman and Lewis 2020, 71). Over the years of their development, their features have been categorized as increasingly interactive and responsive, to the extent that they have even been viewed as family friends who deserve legal protection (Darling 2016, 22). In many of these instances, such machines are objects of a technologically-induced anthropomorphization process (Epley et al. 2007, 864; Złotowski et al. 2015, 347).

The drive to develop and interact with technologies that appear to reflect the human condition in practice or physical appearance has increased considerably in recent years. Robots in particular have been designed to display varying degrees of human-like features such as stylized facial expressions or human-like voices, supposedly in order to facilitate anthropomorphization: the process by which human characteristics like motivation, behaviors, and social roles are attributed to nonhuman entities (Ezenkwu and Starkey 2019, 340; Coeckelbergh 2023, 2). As shown by Caporael (1986, 218) or Darling (2016, 22), framing technological artifacts through anthropomorphic language and design can influence human perception and behavior and oftentimes ameliorates human–machine relationships.

Closely connected to the role of anthropomorphism is the notion of trust and trustworthy systems. Humans desire a trustworthy (Kok and Soh 2020,

297), friendly (Fröding and Peterson 2021, 207), transparent (Larsson and Heintz 2020, 1), and emotionally intelligent (McStay 2020, 10) machine that not only meets instrumental criteria such as effectiveness and user-friendliness, but also supplements its functional spectrum with a (para-)social dimension in a human-like manner. Many chatbots are not only regarded as trustworthy, but also present themselves as personal (Cai et al. 2023, 24). ChatGPT, for example, excuses itself for mistakes, acts politely, and addresses users in different ways. When Olasik (2023, 269) titled her paper "Good morning, ChatGPT, Can We Become Friends?", she provided a vivid example of the expectations regarding relationships with a technological interface.

Many other researchers confirm that users exhibit behaviors that can be interpreted as showing empathy with the technical counterpart (Malinowska 2021, 361). Anthropomorphization is not seen as an active projection a priori, but as a passive inference in the moment of sociotechnical interaction experience. This (psychological) process of anthropomorphism is described by Damiano and Dumouchel (2018, 2): "The underlying idea is to actively involve users in the social performances and presence of the robots, by designing robotic agents that stimulate users to attribute human feelings and mental states to robots, which should enhance familiarity and promote social interactions".

We regard anthropomorphization as one of the central modes for bridging the gap between machines and humans. By anthropomorphizing machines, individuals engage in a form of accommodation whereby they adapt their linguistic and physical behavioral cues to better align with the supposed social qualities and performances of the technology. In most human-to-human communication, sociolinguists argue, people adapt their language and behavior according to a desire to establish rapport, reduce social uncertainty, and facilitate smoother interactions. This accommodation process involves both conscious and unconscious adjustments, and is exhibited in interactions with machines as well. Studies have shown that the level of anthropomorphism applied to machines can vary from moment to moment and is influenced by factors such as the machine's design, voice, behavior, and the interaction context. Systems with human-like features, such as humanoid robots or natural-sounding voices, tend to elicit higher levels of anthropomorphism from users (Darling 2016, 22; Wagner and Schramm-Klein 2019, 1). Furthermore, users often employ anthropomorphic language and behavior when interacting with such systems, treating them as social actors rather than as mere tools.

We therefore assume that anthropomorphization not only shapes individual interactions with technical devices but also influences societal perceptions

and norms concerning technology on a more general level. Hence, we argue, it is crucial to understand the mechanisms and implications of anthropomorphization in order to design effective human–machine interfaces and to create conditions that promote positive user experiences. This might also include self-reflection on behalf of humans: Guzman and Lewis (2020, 78), for example, suggest that digital interaction partners – such as Alexa – can be instrumentalized as a stimulus to "reimagine the self". Overall, seeing human qualities in machines is as a fundamental aspect of human–machine communication. It can facilitate smoother interactions, but may also potentially provoke feelings of anxiety; thereby shaping the way individuals perceive and interact with technology across different contexts. There remain, however, many open questions concerning emotional and communicative relations between diverse technologies and the humans that interact with them.

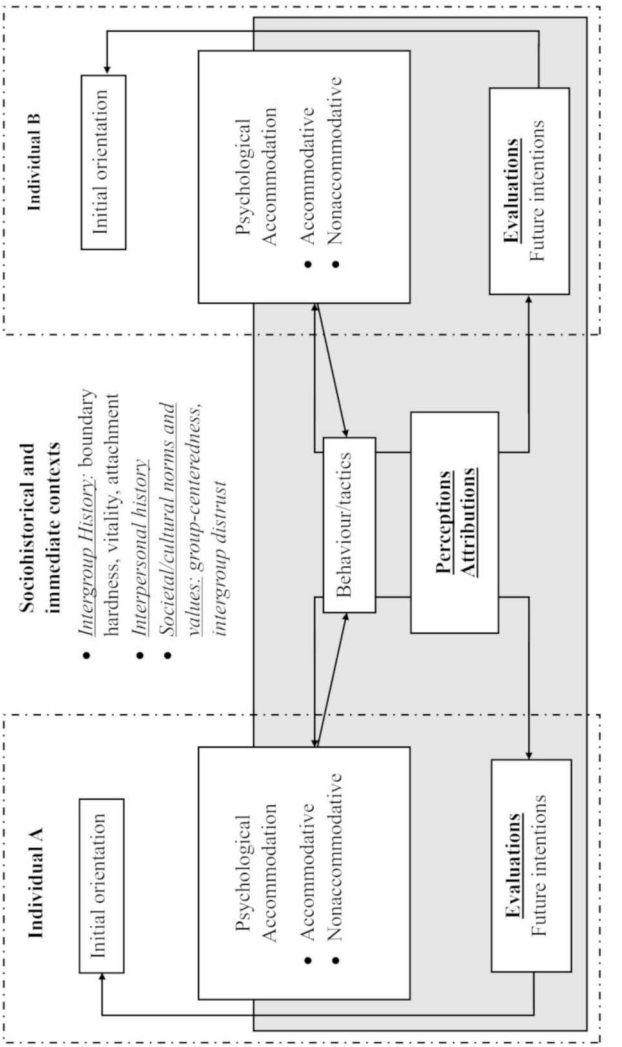
In order to systematically study communicative relations between humans and machines, we adapt the idea of *Communication Accommodation Theory* and expand it for machine technologies.

3. Talking with Machines – the "CAT Technology Equivalence Model"

Initially developed as Speech Accommodation Theory (SAT), Communication Accommodation Theory (CAT) describes how a person adapts their communicative acts towards those of their (human) counterpart. This occurs not only at the linguistic level but includes social relations as well (Schreuter et al. 2021, 535). As Edwards et al. (2023, 2) summarize, "CAT proposes that individuals adjust their communication behaviors in response to the actions of others, on the assumption that communication fosters and maintains interpersonal and group relationships", and Giles et al. (2023, 4) explain that "accommodation regulates social interaction by decreasing or increasing social distance between communicators, thereby often reflecting relative social status and power differentials". The functionalities of communication in interpersonal exchange are complex and are not limited to the verbal. Rather, interpersonal negotiation and attribution of social roles play an important role. CAT asserts that this negotiation process implicitly manifests itself on diverse levels: "Communication is not only a matter of merely and only exchanging information about facts, ideas, and emotions (often called referential communications), but salient social category memberships are often negotiated

during an interaction through the process of accommodation" (Giles and Ogay 2007, 294).

Figure 1: Revised model of Communication Accommodation Theory (Gallois et al. 2005, 135)



The ways in which individuals accommodate to their human communication partners have been characterized in relation to social status, language variety, and individual speakers' characteristics, among others (cf. Gallois and Giles 1998), with the following convergence strategies identified:

- upwardly or downwardly converging towards the degree of prestige, where relevant, of the language variety used by the communication partner;
- fully or partially accommodating a specific speaker characteristic or a particular constellation of characteristics;
- symmetrically or asymmetrically accommodating such that both or only one partner converges;
- converging at different paces and/or to a varying degree within a single conversation or over a longer time period.

Important factors that can influence the effectiveness of communication according to CAT are the sociohistorical and immediate contexts as well as perceptions and attributions. Gallois et al. (2005, 135) map out the different levels in the following model:

The capacity of CAT to further our understanding and observation of the effects of accommodation has been empirically tested in numerous ways (Gallois et al. 2016, 192). In addition to linguistically-focused studies of accents and dialects, the interaction patterns of convergence and divergence have been the subject of much socio-psychological research. Convergence, as an interpersonal goal, describes the alignment of one's own communicative behavior with the patterns and communication habits (conscious or unconscious) of the other person. Convergent linguistic styles contribute to the formation of sympathy and familiarity, reduce feelings of insecurity and social anxiety, and increase the chances of correctly predicting the behavior of the counterpart and thus aligning the social interaction with one's own need for compliance (Soliz and Giles 2014, 4). Divergent interaction patterns emphasize differences in language and expressive behavior, highlighting the differences between one's own and another's personal or group identity. Convergence and divergence strategies share a common normative starting point with the psychoaffective need for coherence, as divergence strategies often reflect an attempt to uphold the authenticity and integrity of one's own personality against environmental influences.

Whereas these categories have been well researched and the substantial body of research addressing human-to-human communication continues to

expand, it is only recently that CAT has been applied to communication with technology (Giles et al. 2023). The starting point of such CAT-based research is the observation of how linguistic styles or linguistic behaviors are adapted in communication scenarios involving a (technological) interaction partner. In interpersonal human-to-human communication research, accommodative behavior is seen as an attempt to incite attitudes of recognition or acceptance; to increase the efficiency of communicative exchange; to create, maintain, or reduce social distance; and to enable the negotiation and maintenance of shared personal and collective identities (Gallois et al. 2005, 127). Research on lexical alignment in particular in human–machine communication (HMC) suggests that here too, users adapt their lexical choices to accommodate their partner's perceived limitations as interlocutors, with greater adaptation to partners perceived as less capable or eloquent (Branigan et al. 2011, 41). Branigan et al. (2010, 2360) suggest that people see agents with human-like qualities as more intelligent and competent than non-anthropomorphic agents. The tendency to align therefore appears to be mediated by evaluations concerning an interlocutor's perceived communicative capacities and deficits, with most humans implicitly assuming that humans' communicative capacities are superior to those of machines.

In recent years, a number of studies have investigated human interactions with social robots (Ahmad et al. 2017, 21; van Pinxteren et al. 2023, 537), productively employing the *computer as social partner* approach (Fortunati and Edwards 2022, 17). The launch of commercialized voice-operated agents like the Google Assistant (2012), Microsoft's Cortana (2013), and Amazon's Alexa (2014) for use in homes and domestic living spaces has added a fruitful context for this perspective as well as for CAT by introducing new communication partners, new modes and norms of communication, and new challenges (Etzrodt and Engesser 2021, 57; Gallois et al. 2016, 206). Studies on communication accommodation to VA systems shed light on how human speakers adapt their communication styles towards those of the devices, particularly in terms of speaking speed and vocal imitation. Linguistic analyses such as Cohn et al. (2019, 1816; 2021, 10) or Cohn et al. (2023, 14) demonstrate particularly clearly that linguistic performance levels are highly dependent on the perception of the sociotechnical interaction as a social situation. And Schreuter et al. (2021, 535) have shown that a VA's voice quality influences the degree to which humans adapt to or even obey it. This supports the conclusion of other studies that it is very much a question of communication attitudes toward machines that guides actual behavior in human–machine interaction (Etzrodt et al. 2022, 439). This extends

beyond linguistic convergence: Etzrodt and Engässer (2021, 73) observed how participants modify and hybridize their ontological differentiation between object and subject to facilitate interaction with voice assistant systems.

If social actors such as VAs (Nass et al. 1994, 72) are to engage meaningfully in a social way to enable and support autonomous agency and decision-making, and if successful communication with them is a precondition for achieving just that, then convergent and divergent acts of accommodation should be regarded as an important factor in human–machine relations. In order to examine our approach in practice, this chapter attempts to apply the principles of CAT to interactions between humans with special needs and their VAs. Our core interest is to explore how participants themselves perceive, describe, and critically assess their own convergence towards the communicative styles and capacities of their speech assistants. Our approach is conceptionalized as the "CAT-Technology Equivalence Hypothesis": we assume that users apply similar social expectations and behaviors to technology as they do to humans. If this is the case, we can assume that individuals need to apply certain anthropomorphization strategies to the technical object. Epley et al. (2007, 866) identify three psychological triggers for anthropomorphic thinking:

a) *elicited agent knowledge*: the accessibility and applicability of anthropocentric knowledge
b) *effectance motivation*: the motivation to explain and understand the behavior of other agents
c) *sociality motivation*: the desire for social contact and affiliation

They claim that "people are more likely to anthropomorphize when anthropocentric knowledge is accessible and applicable, when motivated to be effective social agents, and when lacking a sense of social connection to other humans" (Epley et al. 2007, 864).

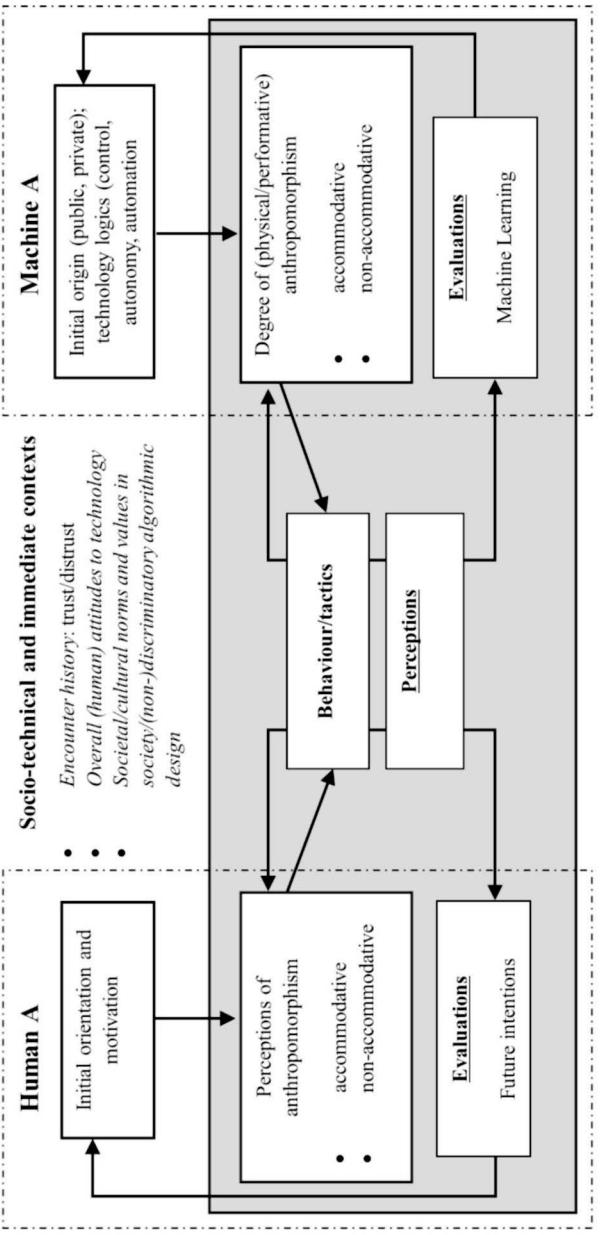
In our study, we employed an adapted model of CAT, based on the basic premises of accommodation and non-accommodation. As the interaction partner in HMC is technology, it is essential to reflect upon the qualities and limitations of the logics of the technology. As explained elsewhere (Thimm 2018, 116), the concept of *technology (or media) logic* refers to the affordances and limitations of a specific technology on various levels. To investigate accommodation practices with technological artifacts, it is necessary to recognize the distributed agency of humans and nonhumans that is at play in sociotechnical situations. Rather than thinking of the affordances of technology as a one-

way relationship whereby either the technology affords something to users, or users afford things to technology, the important role played by algorithms renders notions of unidirectionality obsolete. Interactions with AI-driven chatbots, such as ChatGPT, present a dynamic landscape that defies simple linear explanations. These interactions are influenced by a variety of factors, including the sophistication of the AI, user expectations and experiences, contextual nuances, and cultural influences. As AI technology continues to advance, the intricacies of these interactions evolve, making it ever more inappropriate to try to reduce them to a linear framework. Successfully navigating this terrain requires a comprehensive understanding of the multifaceted elements at play. Hence, we propose the "CAT Technology Equivalence Model":

The accommodation-related activities clearly exhibit greater complexity on the part of the human interlocutor, at least at present. Humans not only possess *culturally and norm-based values and expectations towards technology*, they also harbor personal histories, experiences, and needs concerning the relevant machines within *sociotechnical and immediate contexts*. Moreover, immediate contextual factors, such as special needs on the part of humans as in our sample, influence human behavior and strategies. *Encounter history* denotes the trend toward personalized technologies tailored to the specific needs and preferences of human users. Occasionally, users implement adaptations of the original technology in order to facilitate communication. An illustrative example of such an adaptative measure was reported in our case study, in which a person's specific handicap rendered verbal interaction with the VA impossible, necessitating the use of an amplifying device to enable functionality. As our model is primarily rooted in CAT principles, it is inclined to attribute less agency to the machine. As machines are developed to incorporate ever more human-like characteristics, with social robots gaining enhanced competencies and finding broader application contexts, constraints on the side of machines may diminish over time.

For our own study, however, the current sociotechnical restrictions of Alexa reflect the state of the art of the VAs in use at the time of our study in 2023.

Figure 2: CAT Technology Equivalence Model



4. Communication with Machines in Contexts of Dependency

4.1. The Study: VAs in Households with Individuals with Special Needs

In order to investigate the hypotheses proposed above, we conducted a qualitative case study with four households, which each had at least one smart speaker and a person with care needs due to physical disabilities. The participants at the core of the study, referred to here as test persons, all had a diagnosed disability that impaired their mobility and physical action. Two further interlocutors had no care needs but lived together with two of the test persons in a supportive role. Care, support, and assistance were provided by these carers, relatives, or assisted living facilities. All households owned at least one Amazon Alexa VA.

Since the use of VAs in closed environments such as private households is strongly influenced by subjective impressions, adaptations, and adjustments, we employed a qualitative-ethnographic design for our study. The aim was to record exemplary individual attitudes, impressions, and interaction patterns, and in this way to explore sociotechnical practices and practices of accommodation in daily usage patterns.

Methodologically, the study combined two qualitative, semi-standardized procedures:

a) Individual interviews with all participants including the two caretakers (n = six interviewees)
b) Media journals, filled out by the participants with care needs themselves or by their assistants

In the first semi-structured interview, participants were asked about their attitudes towards the VA itself and about their general usage habits. They then kept a structured media diary for one week to document their usage patterns. Through this process, participants noted their individual media consumption in daily life, which showed implicit routines and interaction dynamics that they might not have consciously thought about before. To ensure thorough documentation and data integrity, no specific time intervals were set for when to note activities in the diary; interaction with the VA served as the sole criterion for when to do so. In a final interview conducted after the survey period, respondents revisited discussions on their usage behaviors, perceptions, privacy concerns, and future outlooks. The interviews were transcribed, structured,

summarized, and subjected to qualitative descriptive content analysis to ensure a comprehensive examination.

The six participants' ages ranged from 23 to 58 years. Two were female and four were male. The households are referred to as households A to D for the sake of anonymity. Household A has three VAs, households B, C, and D have one device each. VAs had been purchased following recommendations from family or friends (A, C), based on personal research (B), or in order to address a specific problem in domestic living (D). The technical installation was carried out independently (A), in cooperation with involved friends (C), spouse (B), or the family environment (D); with the participation of the test persons in all cases. All households had owned their VA for several years at the time of the study (A=3, B=8, C=1.5, D=5).

4.2. Types and Frequency of Interactions

The duration of the study was one week. During this period, the participants kept a media diary and categorized their interactions with the VAs according to a set of criteria such as time of day, duration of interaction, communication objectives, (dis)satisfaction, or verbalization strategies.

In total, 759 interactions with the VA were logged, with the highest interaction rates noted in the morning and late afternoon to evening. The diaries showed that VAs were integrated into daily routines as an inherent part of everyday life. 332 interactions were classified as entertainment, 211 as planning and organizing tasks, 156 interactions operated smart home devices, and 34 were requests for information (see Figure 3). Respondents reported that they would not have been able to perform 667 of the total 759 actions without the VA's help. They deemed the remaining 92 actions would have been possible without technical assistance. However, it is worth noting that in some such cases, like the example of respondent A, the activity would have otherwise been performed by a caregiver.

These results affirm the remarkable relationship between users with care needs and their VAs: users rely heavily on the smooth functionality and effectiveness of their VAs to facilitate the organization and structuring of their daily lives. This creates a communicative situation in which adapting to the machine is crucial: any lack of 'understanding' between user and VA, whether due to machine malfunctions or disability-related communication barriers, would be more than just an inconvenience and could even, as remarked by a participant, significantly reduce participants' quality of life. Figure 4 emphasizes visually

the importance attributed to successful interactions by participants with care needs.

Figure 3: (left): Alexa: Categories of use

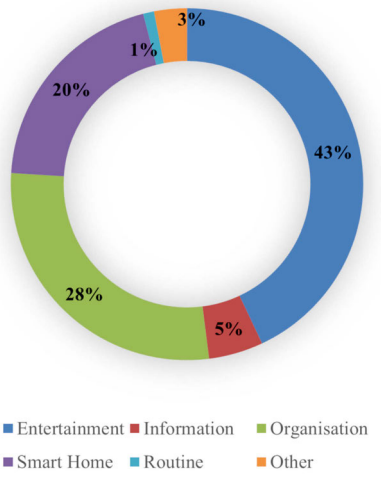
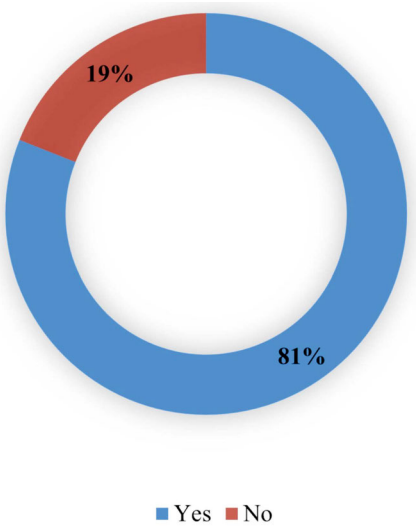


Figure 4: (right): Activity only possible with Alexa



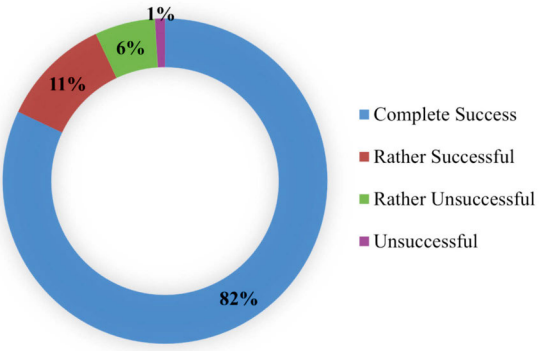
4.3. Verbal Communication

Verbal communication with the VAs was rated as completely successful in 621 of the 759 interactions. In 79 instances, communication yielded reasonably favorable outcomes, while in 48 instances, it proved less than satisfactory. Moreover, in 11 instances, communication endeavors were so unsatisfactory that they were discontinued without the VA having performed the desired task. All 135 interactions involving person D necessitated the involvement of a technical intermediary: the OSC Talker.

Users with disabilities often encounter challenges with speech recognition when interacting with voice assistants. Questions and commands spoken softly or in areas with poor internet connectivity are frequently not processed or answered accurately. Moreover, unclear pronunciation, regional dialects, background noise, or speech impediments related to disabilities further complicate interaction. In situations in which they experience frustration with

their VAs, users are less inclined to view the VA as a partner. Instead, they perceive the VA as a mere machine or service provider, and adjust their behavior accordingly, often accompanied by negative emotions.

Figure 5: Success of Communication



A special case is D. He was initially not understood by his VA due to his unclear manner of pronunciation. To facilitate communication, D made use of an additional technical assistance tool known as the OSC Talker (OnScreen Communicator). The OSC Talker serves to enhance communication capabilities for individuals with disabilities, offering operability through eye movement, button input, or touch interaction. D utilizes the OSC Talker via his computer, leveraging its features, which include email functions, an on-screen keyboard, and various communication interfaces. Of particular value for D, the OSC Talker offers voice output, enabling him to utilize its synthesized speech to engage with Alexa. Tailored communication interfaces have been configured specifically for D, facilitating interaction with the VA and facilitating the activation and management of smart home devices and other functions. Furthermore, D utilizes a joystick on his wheelchair to regulate the power socket of his computer, enabling him to switch it on or off.

4.4. Accommodation to 'Technical Alexa' or 'Anthropomorphic Alexa'

As outlined in section 1 above, we regard anthropomorphization as a bridging concept that can help to explain some of the specifics of human–machine relations. Hence, we used the concept in our categorization of VA usage prac-

tices, identifying patterns that suggest when the VA was perceived as a machine/technological device and when it was approached more as a person/anthropomorphized entity.

In the course of the interviews, we found interesting reflections by our participants which corresponded to elements of our 'CAT Technology Equivalence Model'. In general, the participants exhibited very diverse relationships with their VAs – not just between participants but also for one and the same person in different situations. Participants' characterizations of the VA ranged from the purely technical – "merely a machine" – to the intimately personal – "a trained family member". Each participant demonstrated intrapersonal fluidity in their attributions, sometimes viewing their VAs as solely technical implements, while at other times regarding them with near affection as social companions and aides. This ambivalence is exemplified in the following dialogue between participant B and the interviewer (I):

B: So, you can also whisper to her, and she whispers back.
I: Really?
B: Yes! She can even get offended… didn't you know that?
I: No, I didn't know that.
B: [to Alexa] Alexa, you're a stupid cow. [Alexa doesn't understand B]
B: [to Alexa] Alexa, you're dumb.
Alexa: I don't know everything, but I'm always getting better.
B: But sometimes it also says: That wasn't very nice of you.
I: Okay, so she can also get offended.
B: But she can also be nice. When you thank her, then [speaks to Alexa]: Alexa, that was very kind of you.
Alexa: It was my pleasure. I wish you a lovely Monday.
I: Oh okay, so very polite.
B: Exactly, she also always mentions the day of the week.

Explicit acknowledgment of this ambivalence between human-like performances and the inherent technological nature of the instrument is evident in several other comments, such as:

A: She sometimes acts like a human, but it's just a robot.

Further comments corroborated this inclination of participants to engage with their VAs in a parasocial manner. Person C, for instance, noted that she had begun to use anthropomorphic sign-offs when concluding interactions at the end of the day:

C: Lately, I've said more often: 'Good night, Alexa', and then she says, 'Likewise, thank you, and have nice dreams.

Others mentioned conversing with their VAs simply for entertainment, i.e., using the machine as a substitute for human companionship:

C: Well… sometimes I chat with Alexa just for fun. When I feel like it, when I want to have a chat, I get a slightly metallic voice, but it's okay.
I: Okay. But for you, she's already a bit… well, someone to talk to… to chat with.
C: Yeah, exactly. Like a trained family member, you could almost say.
I: Okay. A trained family member… so almost… would you say not just any technical device, but already approaching becoming a real family member.

In many instances, we observed flexible interchangeability between the two kinds of personae attributed to the VA. A single participant did not consistently address the technological persona, nor an anthropomorphized one; rather, there often appeared to be a fluid switching between the two. Some authors argue that more stable routines of communication and status ascription need to be developed over time (Krummheuer 2010, 105).

When reflecting upon verbal accommodation, participants raised numerous concerns; above all, difficulties in mutual comprehension. Users frequently encountered the need to rephrase commands multiple times in order to achieve a successful interaction. For instance, Person C consistently experienced difficulties when inquiring about the weather report for his location. Likewise, Person B reported similar issues with Alexa. B suspected that these problems might be due to her unreliable internet connection, or that she didn't always speak loud enough for the VA to pick it up correctly. Person A reflected upon the need to accommodate when engaging with the VA in order to achieve successful results:

A: Maybe not differently, but more consciously. And what I also find interesting is that she made more mistakes than I was aware of. So, I feel like I had to repeat things more often without realizing it…

Typical technology based behavior when interacting with VAs mentioned by our participants centered on voice and pronunciation accommodation; comments pointed to accommodations of pitch, speaking volume, repetition, and dialect:

C: Yes, or only after pointing it out clearly three or four times about [location]… then she understands it.

B: No, you have to speak more clearly, otherwise she won't understand. So mumbling or speaking in a strong regional accent, like Colognian, she doesn't understand that at all!

Clearly, the participants learned to converge their verbalization styles towards the capabilities – or rather, incapabilities – of their technological interaction partners. Moreover, the context and purpose of interactions were reflected upon explicitly:

A: No, I mean, I do give her commands. I would never talk to people like that.
I: Okay. So, you order Alexa around, too. Would you say that?
A: Yeah, well, to me, she's not human. And then I don't see the point in having to talk to her like that.

It is worth remembering that for individuals with special needs, the relationship with technology, which serves to support, enhance, and in some instances, facilitate personal autonomy, is distinctly different from that experienced by non-disabled individuals, as explained by B:

B: I don't use them for fun like many others do, but because I need them.

The participants made it clear that without their VAs they would need significantly more help from other people, and they all asserted that their VAs played a very important role in organizing their daily lives. One interlocutor went as far as to say he "*could not imagine everyday life without Alexa*"; another even described his VA as a "*trained family member*". However, when discussing the usefulness of VAs, despite expressing their appreciation for the reduced need for human assistance that the devices facilitate, all participants insisted that they would never want to become dependent on VAs. Indeed, all the participants emphasized that their VA was not a substitute for the social contact they have with their human caretakers. Nevertheless, A, C, and D did assert that voice assistance systems make a significant contribution to equality within society and to improving accessibility.

5. Conclusion and Outlook

The experiences that participants reported in their everyday use of Alexa show a variety of convergence activities undertaken to adapt their communication to the requirements of the VA's system. Describing their own social practices in

interaction with Alexa, the participants portrayed their VAs as a helpful friend, indispensable organizational helper, means of contact with the outside world, and as a safety net. In interactions with participants, Alexa emerged as a companion of shared agency, effectively blurring any distinction between external/instrumental and internal/integral use of technological objects. The study indicates that for some users with disabilities, systems involving AI such as VAs can enhance their personal autonomy and help them to maintain a level of control over their daily activities.

The results of the interviews and the one-week media diaries also highlight a degree of ambiguity characterizing the relationships between users with disabilities and their VAs. On the one hand, participants stressed that Alexa had become an irreplaceable part of their everyday lives, that they could not and would not want to live without her support, and that the voice assistant increased their sense of freedom and independence. Hence, lack of functionality or loss of Alexa was perceived as an enormous limitation. The interviewees, all of whom had been interacting with Alexa for several years, described a high level of familiarity with Alexa and emphasized that she was an integral part of everyday domestic life. The comparison of our methods (guided interviews and media diaries) showed how, in practice, VAs are so deeply embedded into routines that their involvement in actions is often not consciously reflected upon – except when something goes wrong. Additionally, non-communicative adaptations, such as the purchase of additional smart home devices or the acquisition of technical skills to set up and use them, illustrate the practical value of VA systems for people with disabilities.

At the same time, it became clear that users had often been obliged to take drastic measures to adapt their usage and communication behavior to the functional and operational logic of VAs. The spectrum of adaptations ranged from simple to complex accommodations of a convergent and divergent nature. All respondents described the interaction as limited and observed that when communicating with Alexa, idiosyncratic linguistic habits such as regional dialects should be avoided. The limited technical capacities of VAs' voice recognition software often necessitate multiple repetitions, which in turn influence users' attitudes towards VAs and caused frustration for some of our participants. Communication behavior was also adapted at a more general level, with participants describing how they adopted a more demanding, direct, and authoritative tone of voice than they would when interacting with a human counterpart.

Commands and requests in particular have to be articulated clearly, distinctly, and slowly – a communication hurdle that is sometimes difficult for people with physical disabilities to overcome. In the case of D, the necessary convergent accommodation was achieved by means of a technical solution. Because of his own limited speech capacity, he had to install the OSC Talker as technical intermediary that enabled him to communicate with Alexa verbally. The investment of financial resources, the installation of an additional technical device, and the corresponding double adaptation of usage behavior in order to communicate in the mode foreseen by Alexa's designers all illustrate the one-sidedness of this accommodation process: in this example, the human was obliged to adapt to the inflexible technology.

The data presented in this chapter support some of the concepts laid out in the "CAT-Technology Equivalence Model". Most notable are the diverse ways that an attitude of anthropomorphism in dealing with devices manifests itself as part of implicit performative accommodation of communication behavior. Not only does this affirm our contention that anthropomorphization is an unconscious tendency, it also emphasizes the influence of users' emotions upon the status they ascribe to nonhuman communication partners. The attribution of human-like qualities is not only significant in interaction with technological agents such as VAs but also characterizes the reciprocal performances of communication patterns with many other machines (Malinowska 2021). In order to increase the efficacy of communication, both technological and human practices draw upon established patterns and customs of interpersonal communication, but it is the reiterative bilateral exchange of (para-)social cues that evokes anthropomorphic perceptions and, at the same time, ambivalent feelings about the status of smart devices like VAs. In response to Giles et al. (2023, 11) we conclude that users' communicative strategies when interacting with Alexa are initially primarily adaptive towards the technological logics of operation in order to facilitate functionality, but with repetition and long-term exposure they increasingly encompass anthropomorphic experiences and attributions, which in turn shape future interaction practices. Conceptualized through CAT, anthropomorphism bridges the gap between technological usability and status-relevant attributions.

However, the potential of CAT to theoretically map this relational performativity has so far rarely been explored within a communication science framework in studies of human–machine interaction. When Fortunati and Edwards (2022, 8) defined HMC as a form of communication between humans and digital interlocuters, or machines, they proposed that these machines act

as human surrogates, simulating humans' "biological and psychological abilities to formulate, issue, and receive a message and on the basis of this message, to elaborate another message." Recognizing technology as a social partner, our proposed "CAT-Technology Equivalence Model" replaces the second human interlocutor with a communicative machine. Especially in contexts of social robotics, disability, or elderly care, this reintroduction of CAT can build upon prior research that has identified a positive correlation between the human willingness to socialize and the projection of human-like qualities onto robots (Christoforakos et al. 2022, 1059). Focusing on such contexts also has the potential to increase the visibility of marginalized user groups when it comes to developing, integrating, and adjusting AI technologies to individual needs and to furthering our understanding of these groups as early adapters to the functional spectrum of future innovations (Bigham and Carrington 2018, 1). Finally, as technology adopts ever more human-like qualities, including physical form, human voice quality, and ever more human-like verbal fluency, such as in LLMs (e.g., ChatGPT), the question of 'human-likeness' in shaping speech behaviors, and specifically accommodative behaviors, will become an even more significant area of study.

"Is it really accommodation after all, when we tailor our speech and language to what a virtual agent can understand? Or is it simply a matter of verbally learning what buttons to press?" asked Giles et al. (2023, 10), the founder of communication accommodation theory. Perhaps this question will soon be answered by our intelligent partners.

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