Are You Trying to Be Funny? The Impact of Affiliative Humor of Smart Home Technologies on Human-Like Trust

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Abstract

Smart home technologies (SHTs) perform tasks in the most intimate areas of life and therefore require blind user trust from the start. To build this trust, vendors often rely on creating human-like interactions with devices, such as by incorporating humor. Although humor in SHTs is becoming more advanced, e.g., through advanced joke selection algorithms, its actual impact is largely unexplored. In this work, we address this gap and study the impact of affiliative humor as a human-like characteristic on perceived social presence and initial trust in SHTs. To this end, we conducted a vignette-based experiment with potential users (N=63). Our results contribute by uncovering the mechanisms underlying humor as a trust-building characteristic in SHTs. Moreover, in this way, we also provide important insights for the design and communication of SHTs, which can be valuable for vendors to foster perceived human-likeness and thus initial user trust in smart technologies.

Keywords: Smart home technology, smart product, virtual assistant, human-like trust

Introduction

In recent years, smart home technology (SHT) such as smart thermostats or autonomous vacuum robots have witnessed a widespread diffusion and contributed to the digitization of individuals (Touzani et al. 2018; Benlian et al. 2020; Turel et al. 2020). Belonging to the category of smart products, SHTs are cyber-physical bundles comprising a material layer with hardware features such as sensors, cameras, or actuators and a virtual layer with a software operating system (Lee et al. 2020; Raff et al. 2020; Knote et al. 2021). This allows SHTs to have a wide range of capabilities, such as acting autonomously, responding and adapting to their environment or users, and cooperating with other devices while performing different functions (Rijsdijk and Hultink 2009; Raff et al. 2020). However, the most striking feature is certainly that in more and more SHTs, buttons or touchscreens are being replaced with conversational control, letting the user interact with the devices by communicating via voice or chat interaction with a virtual assistant such as Alexa, Cortana, or Siri (Mallat et al. 2017). These can understand human speech or text and can perform all sorts of practical activities in the smart home, such as setting timers, playing music, ordering a cab, and even reading aloud at night if the user asks them to do so. To offer the user a particularly high level of

comfort, SHTs can also receive commands via virtual assistants from outside the house. This works, for example, via the voice or chat function of a corresponding smartphone app (e.g., Alexa app) connected to the respective SHT. Take the Amazon Astro vacuum cleaner, for example, which moves autonomously through the home, sends live images via the Astro app, and interacts with its user via the Alexa virtual assistant – even from a distance when the user is not at home.

Especially if the device is supposed to act independently in such task-oriented contexts in the most intimate area of life, the home, users must have blind trust in the competencies of their smart home devices right from the start. This *initial trust*, often built through advertising and product communication, is especially important when experience- and knowledge-based information is lacking or insufficient, as is often the case with radically new technology (McKnight et al. 1998; Li et al. 2008; Söllner et al. 2016). In practice, making SHT devices appear *human-like* is seen as a crucial way for vendors of SHTs to build user trust in their devices from the very beginning (Benlian et al. 2020). Since SHT devices (e.g., smart robot vacuum cleaners) are generally not human-like per se, i.e., do not appear visually human, vendors thereby rely mainly on spoken or written cues during the user's interaction via the embedded virtual assistant (see also the trustworthy "Alexa Personality"; Amazon 2022). In this context, the use of *humor* as one such cue has recently come into focus. For example, many SHTs today can already understand humor, tell jokes, or give funny answers to unpleasant or nonsensical questions. Thus, SHTs, just like humans, are endowed with a "basic sense of humor".

However, although the inclusion of humor in SHTs is becoming more advanced, e.g., by tailoring jokes to the user's tastes using advanced joke selection algorithms, the effects on users are still largely unclear and the scant research findings are ambivalent. On the one hand, previous research has found that technological artifacts that show human-like characteristics may appear creepy – a finding that has been revealed for robots in general (Mori 1970) and virtual assistants (Yip et al. 2019). Moreover, research has found that humor in technologies may distract users from their tasks, lengthen task processing time, and create inefficiencies for the user (Morkes et al. 1999; Niculescu et al. 2013). Such perceptions may ultimately lead people to resist or discontinue the use of technology (van Offenbeek et al. 2013; Ling et al. 2018; Raff and Wentzel 2018). On the other hand, Ostrowski et al. (2021) found that people tend to consider virtual assistants such as Siri or Alexa to be more trustworthy and emotionally engaging when they exhibit human-like social cues. In addition, research in human-computer interaction (HCI), artificial intelligence (AI) and robotics are working on projects that particularly aim at advancing computational humor, confident that this will make digitally infused real-world environments such as smart cities, smart homes, or smart cars more attractive to humans (e.g., Niculescu et al. 2013; Nijholt et al. 2017). Moreover, research from the hospitality sector has shown that humor can have a positive impact on the acceptance of hotel service robots (Zhang et al. 2021), while Amazon's own research claims that a strong sense of humor in Alexa can have a positive effect on usage and engagement with the virtual assistant (Wiggers 2019). As can be seen, while humor is on the rise in technologies and SHTs in particular, the evidence for its actual effects remains unclear.

In this work, we address this gap by drawing on previous research on affiliative humor (e.g., Martin et al. 2003), perceived social presence (e.g., Qiu and Benbasat 2005), and initial human-like trust in technology (e.g., McKnight et al. 2011; Lankton et al. 2015). Specifically, we examine how SHTs' ability to apply affiliative humor in user-product interaction presented in product presentations can influence initial trust in SHTs, even before initial use. To this end, we first develop a comprehensive conceptual understanding regarding the mechanisms underlying affiliative humor as a potential driver of initial human-like trust and derive several predictions. In a next step, we use a vignette-based online experiment (N = 63) to test them.

Our results make several contributions to research and practice. First, we complement previous research by showing that communicating a technology's ability to use affiliative humor in advertising and product presentations is an effective way to build initial human-like trust in SHTs. Moreover, since initial trust beliefs also proved to be an important driver of usage intentions (Benbasat and Wang 2005; Qiu and Benbasat 2009), our research responds to recent calls to address acceptance issues related to smart technology (e.g., Mallat et al. 2017; Lee et al. 2020; Turel et al. 2020; Yang et al. 2021), while considering specific design-related issues such as human-like capabilities (Baiyere et al. 2020; Schuetz and Venkatesh 2020). Thus, in this way, we also add a new design-related aspect, namely *affiliative humor*, to the broader "design toolbox" for smart technologies established by previous research (e.g., Mani and Chouk 2018; Touziani et al. 2018; Benlian 2020). In addition, the demonstrated positive effects of affiliative humor also have important implications for practitioners for the effective design of SHTs.

Theoretical Background

Affiliative Humor

Previous research on humor has shown that a sense of humor is a desirable personality trait that is valued in others as well as oneself (Anderson 1968; Martin et al. 2003). Joking and laughing with each other as a social phenomenon can have a positive influence on interpersonal relationships (Martin et al. 2003, Martin 2007). Particularly, humor has been identified to function as a signal that is interpreted by the social environment and in turn, influences how an individual is perceived by others (Zeigler-Hill and Besser 2013). Along these lines, humor has been found to be an important interpersonal element in the establishment of relationships with others and to increase feelings of trustfulness, even between individuals who are relative strangers to each other (Martin 2007). The advantage of humor in interpersonal interactions is that it is identified as such by many people (Berlyne 1972) and everyone is genetically susceptible to humor, at least to some degree (Fry 1994).

Regarding the expression of humor, it is important to note that different styles of humor are potentially more or less effective to inspire a sense of trust. In this respect, Martin et al. (2003) distinguish between two utility dimensions of humor. That is, either the enhancement of the self or the enhancement of one's relationship with others. These two dimensions can be combined into four different ways of using and expressing humor in everyday life. These are as follows: *affiliative humor* (i.e., benign and self-accepting), *self-defeating humor* (i.e., at the expense and to the disadvantage of the self), *aggressive humor* (i.e., at the expense and to the disadvantage of one's relationships with others), and *self-enhancing humor* (i.e., to enhance the self in a way that is tolerant and non-detrimental to others) (Martin et al. 2003). These four types of humor can have different effects on people's reactions and thus on building interpersonal relationships, with affiliative humor potentially having the most positive effect (Martin et al. 2003).

Affiliative humor is conceptualized as a benevolent style of humor that serves to enhance relationships with others and to facilitate social bonds (Martin et al. 2003; Veselka et al. 2010). It is characterized by jokes that are funny, but not hostile, and intended to amuse others in a respectful manner (Kuiper et al. 2016). When using affiliative humor, "*people tend to say funny things, to tell jokes, and to engage in spontaneous witty banter to amuse others, to facilitate relationships, and to reduce interpersonal tensions [...]. This style of humor is expected to be related to extraversion, cheerfulness, self-esteem, intimacy, relationship satisfaction, and predominantly positive moods and emotions*" (Martin et al. 2003, p. 53).

Due to its interpersonal orientation and benevolent disposition, individuals who express affiliative humor have been found to be rated more favorably in comparison with individuals expressing other types of humor, especially those that aim at enhancement of the self (Zeigler-Hill and Besser 2013). Moreover, the expression of affiliative humor has a positive effect on recipients' desire to continue interactions with persons who use this type of humor in conversations (Kuiper at al. 2010). Finally, the use fo affiliative humor is linked to the development of intimacy (Kuiper at al. 2016). This is of particular importance as SHTs are designed to independently operate in one of their users' most intimate spheres of life, their home.

In this research, we suggest that humor may not only be experienced in social contexts but also in response to some technologies such as SHTs. More specifically, drawing on the "computers are social actors" paradigm and the "media-equation hypothesis" (Nass et al. 1994; Reeves and Nass 1996; Nass and Lee 2001) we postulate that affiliative humor can have a positive effect not only on the relationship between humans but also on the relationship between humans and technologies. The reason for this is that people tend to treat computers and IT artifacts that elicit social responses as if they were social actors, and apply social rules and expectations to them as they do to humans (Reeves and Nass 1996; Nass and Moon 2000; Hess et al. 2009; Qiu and Benbasat 2009; Al-Natour et al. 2011). However, the degree to which people treat technologies as social actors and respond to them accordingly depends, among other things, on the extent to which the technologies in question feel human-like and are perceived as socially present (Gefen and Straub 2003; Lankton et al. 2015). In the next step, we will elaborate in more detail on the construct of *social presence*.

Perceived Social Presence

In its original meaning, social presence describes the degree of salience (i.e., the quality or state of being present) between two individuals using technology-mediated communication and the consequent salience

of their interpersonal interactions (Short et al. 1976). More precisely, social presence is an ability (or quality) of a communication medium to convey the feeling of sociability, warmth, and personalness. Social presence is not binary, but more of a continuum where the referred individuals can be more or less present. Short et al. (1976) consider social presence as a critical attribute of a communication medium that can determine how people interact and communicate. In this respect, communication media differ in their ability to convey social presence, with face-to-face communication offering the best results among all forms of communication. In this sense, a technology's ability to transmit information through, for example, facial expressions, gaze directions, postures, clothing, and non-verbal cues strongly contributes to the perceived social presence of a communication medium. However, the impact of the above cues on the individual's perception of social presence is person-dependent, as the social presence of a medium is a function of perception and attitude (Short et al. 1976).

Initially, research has mainly investigated the influence of computer-assisted communication (in which people interact with other people via technology) on social presence (e.g., Rice 1993; Straub and Karahanna 1998; Sia et al. 2002). More recently, research has also started to examine the effects of certain *technological characteristics* on perceived social presence in human-technology interactions (e.g., Qiu and Benbasat 2005; Hassanein and Head 2007; Hess et al. 2009; Al-Natour et al. 2011; Lankton et al. 2015). In this respect, it has been revealed that the feeling of "being together with someone real and present" is not limited to humans only but can also be conveyed by technology that exhibits human-like characteristics. In this context, just as Short et al. (1976) postulated, qualities like sociability, warmth, and personal contact of the technology with the user play an important role in building social presence (Gefen and Straub 2003). Thus, its greater resemblance to a human being through having certain human-like characteristics and/or social cues enhances the sense of social presence (e.g., Lankton et al. 2015).

SHTs, especially when controlled by an app from outside the home, typically have neither a human appearance nor a human voice (e.g., chat dialog with the smartphone app Alexa). Thus, at first glance, fewer social cues are conveyed compared to, for example, a humanoid robot or virtual avatar, which should result in a lower level of perceived social presence. This is precisely where affiliative humor as a behavioral cue might play an essential role in helping designers humanize non-humanoid SHTs and infuse them with a social presence (Pfeuffer et al. 2019). Specifically, the use of affiliative humor in SHTs can potentially integrate a sociable and relational feature, leading to higher levels of perceived human-likeness and social presence. Therefore, social presence theory is relevant when considering the influence of affiliative humor on trust in SHTs. That is because humor, as a human-like characteristic, is supposed to enhance social presence, and social presence, in turn, can enhance trust (Gefen and Straub 2003; Qiu and Benbasat 2009; Lankton et al. 2015).

Trust in Specific Technology

Trust is an important driver in the acceptance process of new and innovative technologies (e.g., Gefen et al. 2003; Benbasat and Wang 2005; Kim et al. 2008; Lankton et al. 2015; Warkentin et al. 2017). In particular, *initial trust* has the potential to determine whether a new technology will succeed in the market or not. In the following, we will elaborate on the construct of trust in the context of SHTs.

McKnight et al. (2011) have introduced and operationalized the concept of trust in technology. Besides the established concepts for trust in people or organizations, trust in technology is intended to specifically help study people's trust in IT artifacts. In this regard, McKnight et al. (2011) focus on the technology itself and its peculiarities to determine precisely what – i.e., which technology characteristics – make a specific technology trustworthy. The authors argue that trust situations occur not only when people are vulnerable to other people or organizations, but in any trust situation in which one must make oneself vulnerable by relying on another person or object, regardless of the will or intent of the trustee. Technologies may differ in the extent to which they are perceived to be human-like, and thus can be evaluated based on either more technology-related or more human-related attributes (Lankton et al. 2015). In line with this reasoning, Lankton et al. (2015) distinguish two different conceptualizations of trust. These are *system-like trust* and *human-like trust*. Human-like trust emerges, for example, when a technology exhibits specific human-like behavior or has a human-like appearance. If this is not the case, system-like trust is likely to prevail in human-technology interactions. System-like trust refers to beliefs regarding the *functionality* (the belief that a technology has the functions or features to do what needs to be done), *helpfulness* (reflecting the

technology's capability to provide an assistive function that is both adequate and responsive), and *reliability* (the belief that a technology works consistently and predictably) (McKnight et al. 2011).

Following the understanding and conceptualization of McKnight et al. (2011) and Lankton et al. (2015), this work focuses on *human-like trust* beliefs. In specific, these can be defined as a function of the integrity (i.e., the belief that the trustee adheres to a set of principles that the trustor finds acceptable), competence (i.e., the belief that the trustee has the ability to do what the trustor needs to have done), and benevolence (i.e., the belief that the trustee will want to do good to the trustor, aside from an egocentric profit motive) of a specific technology.

Furthermore, in this research, we focus on *initial trust* (based on the trustor's judgments before he/she makes any experience with the object of trust) and not experiential trust (based on experience and knowledge of the trustor regarding the trustee) as differentiated by McKnight et al. (2011) and McKnight et al. (1998). The reason for this is that with radically new, innovative technologies such as SHTs, the average potential user has little or no experience with the device and therefore may not be able to base her confidence on facts or her own experience.

In summary, we propose that "affiliative humor" as a human-like characteristic has the potential to make non-humanoid SHTs appear more human in their communication with their users by giving them a social touch. This in turn can help establish a social presence, leading to initial human-like trust. Thus, potential users are expected to respond to humorous non-humanoid technologies with similar familiarity as they do to humorous humans. In the following, we elaborate on these relationships in more detail and derive hypotheses.

Hypotheses Development

The Multiple Effects of Affiliative Humor on Perceived Social Presence

Our research model builds on the theory of social presence and social response theory which emerged from the "computers as social actors" paradigm (Reeves and Nass 1996). As outlined above, social presence theory states that human-like characteristics and/or social cues that are conveyed by a technology increase feelings of "being together with someone real and present" (Biocca et al. 2003). According to social response theory, these intensified feelings of social presence cause people to respond to such technologies as if they were actually human, which ultimately increases people's trust beliefs in these technologies (Qui and Benbasat 2009; Lankton 2015). In this way, on the one hand, our research builds on the findings of Qui and Benbasat (2009), who show that specific anthropomorphic design cues drive the perception of social presence and thereby increase trust among users. On the other hand, we extend this line of research by introducing the specific anthropomorphic design element of affiliative humor as another potential driver that has received little attention in previous IS/HCI research. That is, in our research, we postulate that the affiliative humor SHTs use in their communication with users has several effects on perceived social presence and thus on initial human-like trust: First, affiliative humor should increase perceived social presence indirectly via the two mediators perceived personality similarity and perceived enjoyment of communication/contact. Second, known for being an important social element in human-human relationships, humorous communication should also have a direct effect on the social presence of SHTs. In what follows, we will elaborate on these proposed relationships and present our hypotheses, drawing on the IS literature as well as literature from the fields of psychology and humor research.

According to previous research, people consider a sense of humor as a social asset and also highly appreciate humor in others (e.g., Cann and Calhoun 2001). As a cue affecting initial attraction between two persons, having a sense of humor is even more important than, for example, sharing many of the same opinions (Cann et al. 1997). Since humor is often regarded as an inherent characteristic in oneself and a desirable characteristic in others, people should perceive humorous others as self-similar (Morkes et al. 1999). In our research, perceived similarity refers to users' perceived match between their own personality characteristics and those of the SHTs used. Previous IS research in the field of technology as a social actor has already studied the extent to which, for example, different communication modes of technologies (text vs. speech), as well as other technological design cues (e.g., decision-making strategies), may affect such perceived personality similarity (Al-Natour et al. 2011). Extending these lines of research, and considering affiliative

humor as a yet under-studied technological design cue, as well as drawing on the above mechanisms derived from the humor literature, we hypothesize:

H1a: *SHTs that exhibit affiliative humor will increase perceived personality similarity on the user's side.*

As mentioned earlier, affiliative humor serves to entertain others without provoking hostility. Affiliative humor allows to socialize and easily build interpersonal relationships while reducing interpersonal tension. Affiliative humor can therefore be classified as amusing, benign, benevolent, and non-destructive (Martin et al. 2003; Yip and Martin 2006). According to social response theory that emerged from the "computers are social actors" paradigm (Nass et al. 1994), people react to computer-based technology in much the same way as they do to human beings. That is, humor normally leads to a good mood, resulting in more favorable evaluations of the humorous other (Morkes et al. 1999), which should also hold for the communication with SHTs. Based on this knowledge and the more general notion that aspects of human-likeness can positively influence perceived enjoyment of human-technology interactions (e.g., Al-Natour et al. 2005; Qiu and Benbasat 2009), we expect that users will enjoy interacting with SHTs that exhibit affiliative humor as a human-like design feature in a manner similar to being entertained by a human. Therefore, we hypothesize:

H1b: *SHTs that exhibit affiliative humor will increase perceived enjoyment of communication/contact.*

When technologies are designed to appear reasonably human, i.e., they look human, move like humans, behave human-like, and even exhibit human emotions, they are usually more likely to create social responses and be perceived human-like than technologies with less human characteristics (Zlotowski et al. 2014). In addition, behavioral factors generally have a stronger influence on perceived human-likeness than physical appearance (Zlotowski et al. 2014; 2015). Therefore, technologies that exhibit social behavior through funny communication should strongly promote the perception of human-likeness and thus social presence. Affiliative humor will translate directly into higher perceptions of SHTs' social presence, as focused and selective attention to SHTs' human characteristics (as in our case, affiliative humor) ought to mean that SHTs are directly perceived as more human-like and social, and therefore more socially present (Al-Natour et al. 2011).

H2a: *Affiliative humor will directly increase perceptions of social presence.*

The similarity attraction hypothesis states that "similarity is more important and predictive of subsequent evaluations than the independent assessment of the target's characteristics" (Al-Natour et al. 2011, p. 356). That means that IT artifacts that achieve a higher fit between their own personality and that of the user are evaluated more favorably or enjoy higher user preference (Govers and Schoormans 2005). Previous research indeed shows that people are attracted to computers that exhibit a "personality" similar to their own (e.g., Nass et al. 1995; Moon and Nass 1996). Along these lines, previous IS research has shown that the perceived personality similarity of a technological artifact has a positive effect on the perceived enjoyment of interacting with a technology (Al-Natour et al. 2005). We, therefore, suggest that being aware of SHTs' characteristics and their fit with one's own personality will lead to increased perceptions of communication quality (Davis 1981; Nass et al. 1995) and thus likewise lead to higher scores in perceived enjoyment of communication/contact with a specific SHT. Thus, we hypothesize:

H2b: *Perceived personality similarity induced by affiliative humor will increase perceived enjoyment of communication/contact.*

Enjoyment of communication, as well as perceived personality similarity, are emotional and cognitive reactions that people are familiar with from their humorous human-human interactions. Therefore, users should associate such reactions with a higher human-likeness of the humorous technology. Higher human-likeness, in turn, is proposed to translate into a perceived social presence (Lankton et al. 2015; Moussawi et al. 2022). In a similar vein, also previous IS research on technology as a social actor has already suggested that if communication with technology is designed to be playful and enjoyable perceived social presence might increase (e.g., Hess et al. 2009). Thus, we hypothesize:

H2c: *Perceived personality similarity induced by affiliative humor will increase perceptions of social presence.*

H2d: *Perceived enjoyment of communication/contact induced by affiliative humor will increase social presence.*

Perceived Social Presence and Human-Like Trust

In the context of SHTs, social presence can be described as the perception of personal, sociable, warm, and human elements in the respective technology. Social presence, for instance, has been proposed as an antecedent of online initial trust (e.g., Hassanein and Head 2004), and has been empirically shown to have a positive relationship in the context of human-IT artifact interaction (e.g., Gefen and Straub 2003; Hess et al. 2009; Qiu and Benbasat 2009; Ogonowski et al. 2014; Ostrowski et al. 2021). Lankton et al. (2015) state: "Social presence can increase trust because it reduces perceived ambiguity and risk, which results in more positive attitudes including perceptions that the technology is more trustworthy" (p. 885). According to Gefen and Straub (2003), social presence can also build trust because it provides trust-building cues (e.g., body language and other physical cues). Also, media (e.g., online chat boxes on websites) that exhibit more social cues are usually perceived as being more transparent and, as a result, more trustworthy (Ogonowski et al. 2014). Specifically, when not affected by other known determinants of trusting beliefs (e.g., disposition to trust and institution-based trust), initial trust benefits from social presence (Hess et al. 2009). A similar relationship is also expected in the context of SHTs. Thus, we hypothesize:

H3: *Perceived social presence will increase initial human-like trust in the SHT.*

Figure 1 summarizes our conceptual model and the hypothesized relationships. In the following, we describe our experimental study designed to investigate our propositions.

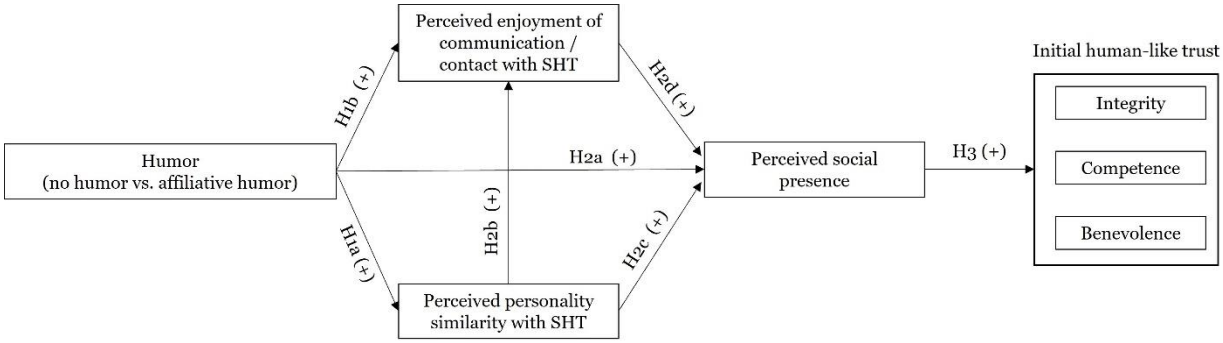


Figure 1. Conceptual Research Model

Method

Design, Participants, and Procedure

Our study aimed to test the relationships depicted in our research model (see Figure 1). To this end, we chose an experimental factorial design. Specifically, our study employed a single factorial design (humor: no humor vs. affiliative humor) online experiment with a between-subjects design. A total of N = 63 participants (M_{age} = 33, 57% female) were recruited by street intercept and subsequently received an invitation including the link to participate in the experiment. Six vouchers from a popular retailer were raffled among all participants as a potential reward.

After reading a general introduction, participants were randomly assigned to one of the two conditions of the study. We used vignette descriptions as stimuli, which represents a common approach for studying the effects of different technology designs (Jörling et al. 2019; Benlian et al. 2020). These consisted of two parts respectively (1) a video and (2) a chat-like communication in the form of a simulated live chat between a smart home product and its user. In the video, a smart vacuum robot called "VacBot" was introduced by demonstrating its general features (e.g., ability to clean all kinds of floors – wet and dry, thoroughness, detection, and avoidance of obstacles such as furniture and pets, ability to recharge or return to the charging station once its job is done, ability to be monitored and controlled from anywhere via a smartphone, etc.). After the video ended, participants were shown a live dialog between the smart robot vacuum cleaner and its user through a messaging app used to control the device. This dialog contained the key manipulation: In

the affiliative humor condition, the smart vacuum robot was witty and made situational jokes when communicating with its user about what needed to be done in the home. In the no humor condition, communication between the smart vacuum robot and its user about what needed to be done was neutral. Apart from the humorous vs. non-humorous passages, both dialogs and the context in which they occurred were identical. For a better understanding of the experimental stimuli, an example of some of the communication is shown in Figure 2.

Measures

After watching the video and reading the dialog between the smart vacuum robot "VacBot" and its user, participants completed measures of affiliative humor, perceived enjoyment of communication/contact, perceived personality similarity with SHT, perceived social presence, and human-like trust. Wherever possible, scales were adopted from prior research and adjusted to the context of SHTs: affiliative humor (Martin et al. 2003), perceived enjoyment of communication/contact (Davis 1989; Davis et al. 1992), perceived personality similarity with SHT (Govers and Schoormans 2005), perceived social presence (Gefen and Straub 2003; Al-Natour et al. 2011), and the three dimensions of human-like trust, i.e., integrity, competence, and benevolence (McKnight et al. 2011; Lankton et al. 2015). All items were measured using a seven-point Likert scale, the anchors being "do not agree at all" and "strongly agree".

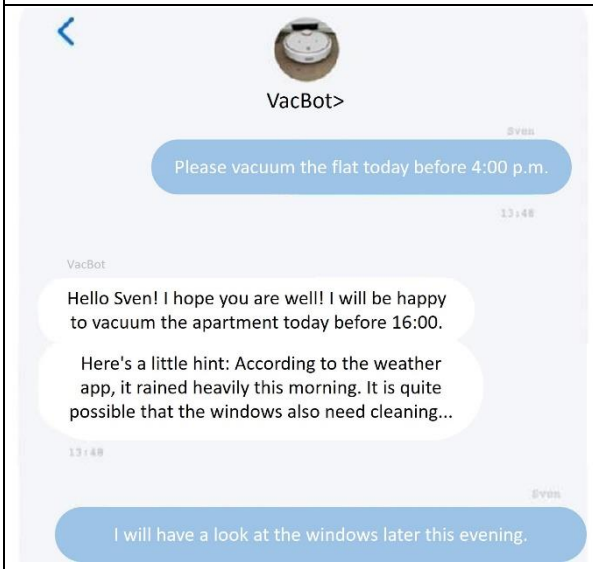
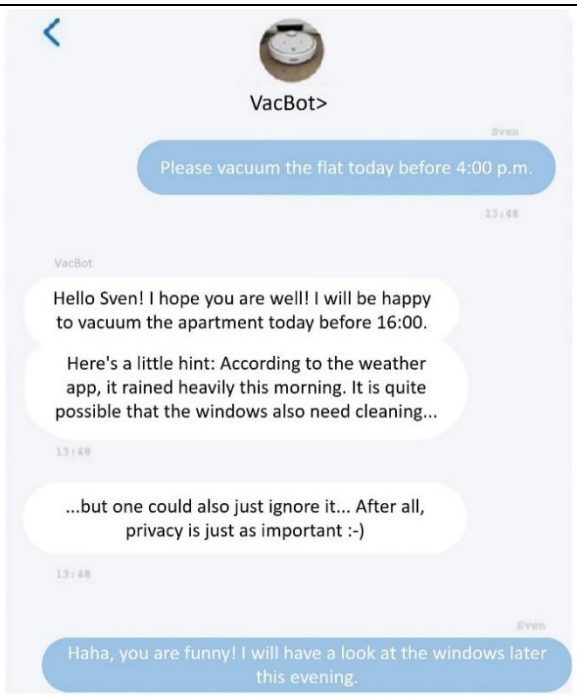
No Humor Condition	Affiliative Humor Condition
	

Figure 2. Experimental Stimuli: Illustration of Chat Dialog

Data Analysis and Results

To analyze our experimental data, we first conducted a manipulation check to ensure that the manipulation of the factor affiliative humor was successful. Second, we assessed the instrument validity, as we used reflective latent constructs in our model that were represented by multiple items. Third, we tested our proposed hypotheses by using a Partial Least Squares (PLS) approach.

Manipulation Check and Instrument Validity

To verify the effectiveness of the experimental manipulation, a one-way ANOVA was conducted on the "affiliative humor" scale. As expected, perceived affiliative humor was higher in the affiliative humor

compared to the no humor condition ($F(1, 61) = 11.59$, $p = 0.001$; Mno humor = 4.00; Maffiliative humor = 5.10).

This study used existing validated scales for most of the latent constructs. To ensure the reliability of the scale items, we calculated the composite reliability (CR) and Cronbach's alpha (CA) for each scale. All CR scores were around 0.9 and all CA scores were greater than 0.9, thus exceeding the respectively required threshold value and demonstrating sufficient scale consistency and reliability (Barclay et al. 1995). To ensure that each item correlated strongly enough with its construct's composite value, we used the cross-loadings report of the PLS analysis. We also calculated the average variance extracted (AVE) of all constructs which measures the variance captured by the indicators relative to measurement error, as well as the square root of AVE, which needs to be larger than the correlations between constructs (Fornell and Larcker 1981). All AVE scores exceeded the required value of 0.5 and the square roots of AVE were higher than the correlations between constructs, which justifies the use of the chosen constructs in our model. As evident in Table 1 the three dimensions of initial human-like trust (integrity, competence, and benevolence) show substantial cross-loadings and high internal consistencies indicated by their respective CAs. For further analysis, we collapsed the individual indicators of the respective dimensions by calculating the mean values of the scales and included initial human-like trust as a single reflective latent variable into our structural model. The final overall results of instrument validity are presented in Tables 1 and 2.

	AH	PPS	PE	PSP	INT	COM	BEN	CA	CR	AVE
AH	**1.00**	.210	.122	.271	.112	-.063	.057	1.00	1.00	1.00
PPS 1	.162	**.955**	.532	.556	.310	.094	.251	.957	.969	.887
PPS 2	.190	**.916**	.538	.620	.377	.122	.291			
PPS 3	.228	**.933**	.567	.575	.341	.121	.321			
PPS 4	.206	**.962**	.548	.605	.321	.123	.262			
PE 1	.014	.582	**.850**	.472	.422	.337	.349	.867	.918	.790
PE 2	.187	.386	**.879**	.562	.589	.480	.447			
PE 3	.127	.564	**.935**	.693	.560	.371	.460			
PSP 1	.155	.527	.605	**.912**	.549	.453	.503	.919	.939	.754
PSP 2	.214	.537	.488	**.865**	.282	.267	.325			
PSP 3	.265	.665	.617	**.863**	.377	.266	.325			
PSP 4	.176	.511	.478	**.833**	.429	.330	.406			
PSP 5	.367	.489	.636	**.868**	.405	.385	.468			
INT 1	.180	.354	.519	.435	**.927**	.502	.664	.853	.912	.776
INT 2	.093	.375	.559	.455	**.927**	.574	.713			
INT 3	.012	.204	.474	.374	**.781**	.535	.570			
COM 1	.037	.182	.411	.365	.606	**.903**	.623	.922	.950	.865
COM 2	-.132	.066	.431	.397	.570	**.956**	.700			
COM 3	-.076	.097	.382	.350	.519	**.930**	.729			
BEN 1	.040	.303	.470	.493	.682	.713	**.931**	.880	.923	.801
BEN 2	.102	.235	.424	.457	.695	.671	**.933**			
BEN 3	-.012	.275	.355	.265	.609	.573	**.817**			

Note: AH = Affiliative Humor, PPS = Perceived Personality Similarity, PE = Perceived Enjoyment, PSP = Perceived Social Presence; INT = Integrity, COM = Competence, BEN = Benevolence

Table 1. Loadings, Cross-loadings, Composite Reliability, Cronbach's Alpha, and AVE

	AH	PPS	PE	PSP	INT	COM	BEN
AH	**1.00***						
PPS	.210	**.942***					
PE	.122	.581	**.889***				
PSP	.271	.626	.655	**.868***			
INT	.112	.359	.589	.480	**.881***		
COM	-.063	.123	.440	.400	.608	**.930***	
BEN	.057	.299	.472	.474	.740	.735	**.895***

Note: AH = Affiliative Humor, PPS = Perceived Personality Similarity, PE = Perceived Enjoyment, PSP = Perceived Social Presence; INT = Integrity, COM = Competence, BEN = Benevolence
**= Square root of AVE*

Table 2. Fornell-Larcker Criterion: Correlations, Square Roots of AVE

Analysis of Hypotheses

We tested the structural model and its associated hypotheses using SmartPLS (Ringle et al. 2015). In doing so, we estimated the path coefficients and also used a bootstrapping resampling technique which approximates the confidence intervals of the path coefficients and the level of variance explained in the outcome variables. Except for H1b, all hypotheses are supported.

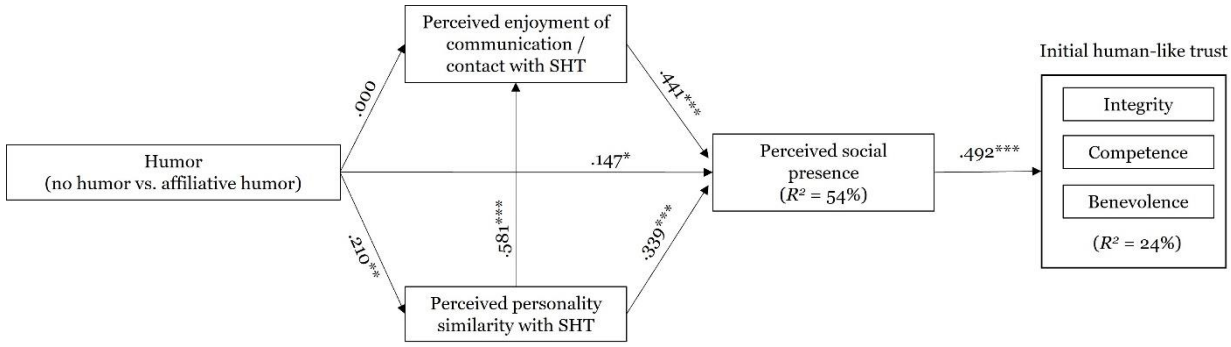
The relationship between affiliative humor and perceived personality similarity with the SHT is significant and shows the direction that was hypothesized (H1a: $\beta = 0.210$, $p < 0.05$). Surprisingly, our findings show a non-significant relationship between affiliative humor and perceived enjoyment in communication/contact with the SHT (H1b: $\beta = 0.000$, $p = 0.499$). Irrespective of its apparent non-existent effect on enjoyment, affiliative humor has a marginally significant direct effect on perceived social presence (H2a: $\beta = 0.147$, $p = 0.060$). Furthermore, as anticipated, perceived personality similarity induced by affiliative humor has a positive and significant influence on perceived enjoyment (H2b: $\beta = 0.581$, $p < 0.001$), and perceived social presence (H2c: $\beta = 0.339$, $p < 0.001$). Perceived enjoyment, in turn, has a strong positive and significant impact on perceived social presence (H2d: $\beta = 0.441$, $p < 0.001$). As anticipated, perceived social presence exerts a considerable positive and significant effect on human-like trust (H3: $\beta = 0.492$, $p < 0.001$). Table 3 shows the overall results containing path coefficients, t-values, and p-values.

As demonstrated above, affiliative humor has a positive direct effect on perceived social presence, but also an indirect effect via perceived similarity and perceived enjoyment in interactions with SHT, all factors explaining 54% of the variance in social presence in total. Perceived social presence, in turn, has a highly significant positive influence on initial human-like trust, explaining 24% of the variance (see Figure 3).

Hypothesis	Path	*t* Value	*p*-Value	Result
H1a (+): AH → PPS	.210	1.83	.034	supported
H1b (+): AH → PE	.000	.001	.499	not supported
H2a (+): AH → PSP	.147	1.559	.060	marginally supported
H2b (+): PPS → PE	.581	7.402	< .001	supported
H2c (+): PPS → PSP	.339	3.249	< .001	supported
H2d (+): PE → PSP	.441	3.957	< .001	supported
H3 (+): PSP → IHLT	.492	5.826	< .001	supported

Note: AH = Affiliative Humor, PPS = Perceived Personality Similarity, PE = Perceived Enjoyment, PSP = Perceived Social Presence; IHLT = Initial Human-Like Trust

Table 3. Hypotheses Results



*Note: path coefficients are depicted; *** α < 0.01; ** α < 0.05; * α < 0.10; n.s.= not significant*

Figure 3. Results of the PLS Analysis

Discussion

The purpose of this study was to determine *whether* and *how* (i.e., via which mechanisms) the presentation of an SHT's ability to apply *affiliative humor* may evoke *initial human-like trust*. To test the predictions of our conceptual model, we pursued an experimental study using product presentations with different humor levels as stimuli. This allowed us, to examine the direct effect of an SHT's affiliative humor on perceived social presence, but also the indirect effects via perceived enjoyment of communication/contact with SHTs and perceived personality similarity. Ultimately, we were able to study the specific influence of perceived social presence on initial human-like trust.

Our findings support that in product communications or advertisements, showing a non-humanoid SHT's ability to apply affiliative humor is effective in building initial human-like trust. That is, affiliative humor actually enhances initial human-like trust by improving the social presence of SHTs through a significant increase in perceived personality similarity. Moreover, we found an effect of perceived personality similarity on perceived social presence through the enjoyment of communication/contact with the SHT of interest. Surprisingly, we did not find a direct effect of affiliative humor exhibited by an SHT on perceived enjoyment of communication/contact with the SHT. One possible explanation for these results could be that our manipulation of affiliative humor was too subtle to elicit significantly stronger feelings of amusement or pleasure compared to communication without humor. Moreover, a direct effect of affiliative humor on perceived social presence exists but is not dominant and only significant on a 90%-level.

Theoretical and Practical Contributions

Overall, we believe that our research can stimulate the current scientific discourse by contributing in multiple ways.

First, existing research has shown that in some circumstances technology can evoke a social presence and that perceptions of social presence can serve as a mediator affecting other technology-related perceptions (e.g., Gefen and Straub 2003; Hassanein and Head 2004; Hess et al. 2009). It has not yet been studied, however, how human-like characteristics such as humor embedded in non-humanoid technologies may affect the emergence of a social presence and, as a result, initial trust. Therefore, we complement previous research by shedding light on this particular connection as well as responding to recent calls by Moussawi et al. (2022) to identify specific contributors to perceived human-likeness in smart technologies.

Second, as we show that communicating a technology's ability to use affiliative humor in advertising and product presentations is an effective way to build initial human-like trust for SHTs, our research responds to recent calls to study acceptance issues in smart technologies (e.g., Mallat et al. 2017; Lee et al. 2020; Turel et al. 2020; Yang et al. 2021), while also considering specific design-related issues (Baiyere et al. 2020; Schuetz and Venkatesh 2020). Thus, in this way, we also add a new design-related aspect, namely *affiliative*

humor, to the broader "design toolbox" for smart technologies established by previous research. While Mani and Chouk (2018) state that smart technologies should be designed *intuitively* and *user-friendly* or Benlian et al. (2020) argue that *visual anthropomorphic design cues* can mitigate the intrusive effects of smart technologies, our findings support that adding *affiliative humor* can increase initial human-like trust in SHTs. Since initial trust has been shown to be an important driver of technology usage intentions (Benbasat and Wang 2005; Qiu and Benbasat 2009) this may promote acceptance and continued use.

Moreover, the demonstrated positive effects of affiliative humor also have important implications for practitioners for the effective design of SHTs. That is, our results support that SHT vendors can apply humor as an effective cue in advertising and product presentation to increase perceptions of social presence and thus initial human-like trust. Therefore, especially in the early stages of the product-user journey, product designers of SHTs should consider embedding and promoting affiliative humor in their products. As our results support, affiliative humor can make a given SHT appear more "self-similar", i.e., its personality resembles that of the user. Such self-similarity, in turn, increases social presence in two ways: indirectly, by increasing the enjoyment of communication, and directly, by appearing more human-like. To further increase the enjoyment of communicating or interacting with SHTs, and thus social presence, product designers and marketers of SHTs might even experiment with using affiliative humor that is more salient than the one used in our study. For SHT devices already on the market, vendors might also consider adding humor retroactively, such as through an over-the-air update as part of a new operating system (Schulz et al. 2021).

Limitations and Future Research

Our study has limitations and provides opportunities for future research.

First, our empirical setting was based on a single scenario in which respondents were presented with an SHT product video and in which affiliative humor was manipulated through a fairly simple manipulation in chat-based dialog (affiliative humor vs. no humor). In addition, parts of the presented dialog ("Haha, you are funny!") in our treatment group might have biased our participants in a certain direction and thus undermined the validity of our results. To overcome these limitations, future research should therefore first attempt to further disentangle affiliative humor and determine its inherent conceptual dimensions as well as its forms of expression and various modes of presentation. For example, previous research has already shown that voice-based communication has a significantly greater impact on users' perception of social presence compared to text-based communication (Qui and Benbasat 2009). Moreover, affiliative humor may take many forms of presentation, from the telling of jokes and witty banter to the sharing of funny anecdotes to the display of humorous pictograms such as emojis, each with possibly very different effects (Martin et al. 2003). Future research could also examine the influence of more extreme forms of affiliative humor. In this respect, it would be interesting to know whether this actually strengthens trust or might even lead to a backlash and undermine trust. By first elucidating these nuances of affiliative humor, future research can afterward delve deeper into the idiosyncrasies of the underlying mechanisms through further laboratory and/or field studies. This will allow future studies to determine whether the effect of affiliative humor on perceived social presence and initial human-like trust remains stable across different forms of expression and modes of presentation.

Second, to isolate the effect of affiliative humor from other influences we used written communication without any other social cues such as a human voice or a human-like avatar in the chat dialog. However, our setting, i.e., the representation of a technology that looks like a technology but communicates in a way that is more like a human, may be considered non-intuitive and ambiguous by some people. In turn, using a human-like avatar in the chat app might help to reduce potential feelings of unfamiliarity, strangeness, and ambiguity and even increase social presence and trust on the other hand. Only recently, IBM Watson introduced "Soul Machines", a technical solution to provide a virtual assistant with a human face. Future research could therefore investigate the effect of humor provided by an SHT in conjunction with such an artificial human face/avatar displayed in the control/chat app.

Third, future research should delve deeper into the mechanisms of human-likeness along different SHTs and application contexts. In doing so, future research could also include additional variables (e.g., perceived uncanniness) and situational factors in their studies (e.g., the discrepancy between humor and the task/role of a technology or the timing of humor). This is important to gain deeper insights into how different aspects of human-likeness in different SHTs (e.g., moving vs. non-moving SHTs, SHTs resembling human shapes

or faces, SHTs with human voices, etc.), as well as situation-specific factors such as the seriousness of the task to be performed affect the relationship between humor and trust. For example, humor might be more welcome in an entertaining cleaning task than in a more serious context such as surveillance. Thus, designing SHTs with an appropriate level of human-likeness and matching appearance, behavior, and the task could both increase trust and acceptance (e.g., Goetz et al. 2003), as well as prevent the SHT from crossing the creepiness line (Mori 1970).

Fourth, our study explores the extent to which affiliative humor can lead to *initial human-like trust* even before SHTs are purchased and used. Future research could delve deeper into how embedding humor can shape the relationship between the user and the SHT device even after purchase, and what principles need to be followed to provide the user with a continuous experience of trust (*experiential trust*) and a pleasant customer experience. In this context, it would also be interesting to see whether the initial human-like trust may wane in importance over the course of use and other forms of trust, which are more closely linked to the reliable completion of tasks in everyday life, come to the fore (*system-like trust*). Future studies should shed more light on these aspects and explore the ways in which the different forms of trust may influence or replace each other.

Last, given that our data collection was pursued in Germany, our findings might be limited due to cultural specificities. Moreover, our experimental study was based on hypothetical scenarios and was tested with an online sample, which is usually a limitation to the ecological validity (Benlian et al. 2020). Future studies should therefore replicate our findings in realistic field study settings and along different cultural populations to ensure the generalizability and robustness of our findings.

Conclusion

Building on previous research on social presence and human-like trust, this study examined the effects of affiliative humor in SHTs as a human-like characteristic on potential users' perceptions of social presence, and thus on initial trust. Specifically, we examined by what mechanisms a non-humanoid SHT's ability to apply affiliative humor may increase its perceived social presence and thus initial human-like trust. As hypothesized, affiliative humor of a smart vacuum robot (as a representative of non-humanoid SHTs) was shown to increase perceived personality similarity on the part of potential users. Also, and as expected, perceived personality similarity increased perceived social presence, while social presence, in turn, increased perceived trustworthiness of SHTs. This was partly since perceived personality similarity increased perceived enjoyment of communication/contact, which in turn increased perceptions of social presence.

Taken together, we believe our research provides important insights into how more trustworthy SHTs can be designed. In closing, we hope that our findings will stimulate future research in this important area, just as we hope that practitioners will find inspiration for viable design solutions for smart home technologies that effectively promote trust as well as increase adoption and acceptance.

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