How social cues in virtual assistants influence concerns and persuasion: The role of voice and a human name

Voorveld, H.A.M.; Araujo, T.

DOI
10.1089/cyber.2019.0205

Publication date
2020

Document Version
Final published version

Published in
Cyberpsychology, Behavior, and Social Networking

CYBERPSYCHOLOGY, BEHAVIOR, AND SOCIAL NETWORKING
Volume 23, Number 10, 2020

DOI: 10.1089/cyber.2019.0205

How Social Cues in Virtual Assistants Influence Concerns and Persuasion: The Role of Voice and a Human Name

Hilde A.M. Voorveld, PhD and Theo Araujo, PhD

Abstract

The aim of this study was to test how two important types of social cues used by virtual assistants today can affect consumer concerns and persuasion. These two cues are modality (voice-based via smart speaker, voice-based via a smartphone, or text-based on a smartphone screen) and the adoption of a human name rather than no name. An online scenario-based experiment ($n = 180$) has shown that participants who were exposed to a voice-based recommendation via a smart speaker were the most concerned about security and found text-based recommendations on a screen to be the most persuasive. Participants who were exposed to a virtual assistant with a human name were less concerned about their autonomy and were more strongly persuaded than those exposed to an assistant without a human name.

Keywords: virtual assistants, persuasion, voice, social cues, smart speaker

VIRTUAL ASSISTANTS ARE voice- or text-activated software agents that interpret requests (usually in natural language) by users and execute commands.[1,2] These assistants, such as Amazon's Alexa, Apple's Siri, and Microsoft's Cortana, are becoming increasingly popular across the globe.[3] Brands have begun to leverage this increasing popularity to make personalized recommendations and influence the consumer's buying process.[4] In this context, it is an opportune moment to study how the characteristics of virtual assistants can influence the way that consumers are persuaded by them. Theoretically, such research is vital as, with virtual assistants, technology is no longer only the medium through which a message is conveyed but can also be seen as the communicator.[5]

Our study focuses specifically on how the social cues frequently used by virtual assistants can influence people's concerns about privacy, security, and autonomy as well as their persuasion knowledge, attitudes toward a recommended brand, and adherence to recommendations. Studies that have adopted the ''computers are social actors'' (CASA) paradigm have suggested that people tend to respond socially to computers.[6,7] Such reactions can be influenced by the presence of even minimal social cues.[8,9] When we consider that virtual assistants are often designed to be human like and interact socially, social cues are a potentially key component of a virtual assistant's persuasive capabilities.[4] In this study, we focus on two key cues: modality (voice vs. screen)[3,5,10] and the use of human names.

Modality: Different Types of Voice and Screen-Based Assistants

Interactions with virtual assistants can take place via a smart home speaker (like Alexa) or a smartphone (like Siri).[1] Because such interactions can either happen solely by voice or have a screen-based interface, we compare three interaction possibilities that differ with regard to the modality used: a voice-controlled smart speaker, a voice-controlled smartphone application, and a smartphone application with a traditional screen-based interface.

Due to the novelty of voice-controlled devices, consumers may have more and different types of concerns when using these interfaces when compared to interfaces that they are more accustomed to, such as (touch) screens.[11] In addition, voice-controlled devices collect other types of personal information, a fact that may lead to different concerns when compared to screen-based devices. For example, people may fear that such devices ''listen'' to conversations.[12–15] A recent qualitative study has shown that the use of microphones and the lack of transparency about smart speaker data practices are central to people's concerns.[14]

Amsterdam School of Communication Research, University of Amsterdam, Amsterdam, Netherlands.

The novelty of voice-controlled interfaces may also influence consumers' levels of perceived persuasive intent. The Persuasion Knowledge Model[16] describes how consumers use their growing general knowledge about persuasion to cope with persuasive messages. Persuasion knowledge represents the general comprehension of how, when, and why one is confronted with persuasive attempts.[17] As people have less experience with receiving persuasive messages via voice-controlled devices than via screens, they are, therefore, likely to be less aware that a recommendation is, in reality, a persuasive attempt.[14,16,18]

People's concerns and persuasion knowledge may subsequently influence the extent to which they are persuaded by recommendations made via an assistant. Previous research has demonstrated that awareness of persuasion attempts usually leads to more critical evaluation among adults, but not among young consumers.[19] Although this relationship has never been tested for virtual assistants, given the highly personalized recommendations that they make, it is not yet clear whether knowledge of persuasive intent will lead to weaker persuasion levels. The same goes for concerns about privacy and security: increased levels of concern do not always lead to protective behavior or more critical evaluations. There is a trade-off between the loss of privacy and the convenience offered.[20–22]

People's attitudes toward the recommended brand and their adherence to a recommendation may also be directly affected by whether a recommendation is made via a voice or screen. Earlier research found that the mode of presentation (text, audio, picture, or video) affects message processing.[23,24] Some authors argue that auditory information, as compared to visual, is characterized by its greater intrusiveness and intrinsic alerting properties,[25] whereas others argue that visual information is easier to process.[26] In the context of virtual assistants, voice can be seen as a cue for the source of information.[27] Traditionally, the source can be seen as the initiator of communication,[28] and the channel is the medium through which it is delivered.[29] However, based on theories regarding human-machine communication, a virtual assistant may be seen as the source of information rather than the channel of communication.[5,30–32] Although people may know that a virtual assistant does not create the information that it provides, they are likely to treat it as an autonomous source with intentions.[27] This may be even more likely if a virtual assistant exhibits social cues such as voice.[30,33–35] As a result, people may respond differently to recommendations when social cues become stronger.

Compared to screen interfaces, voice-based interfaces ''enable more intuitive, convenient, and efficient interactions via or with technology by providing hands- and eyes-free means of communication through spoken language applications.''[30(p431),35,36] One very recent study has argued that interactions with voice-based virtual assistants are more natural and seamless. With regard to utilitarian tasks, Cho et al. demonstrated that people had more positive attitudes toward a virtual assistant that was voice- rather than text-based because it was perceived as more human like.[37] This more intuitive way of communicating may make people engage in less in-depth information processing[30] and, according to the MAIN model, people make snap judgments of information that are usually positive.[38,39] Therefore, consumers may be more easily persuaded via voice than via screens. In sum, our hypothesis is as follows:

H1: A recommendation conveyed via a virtual assistant with a voice interface as compared to a screen interface will yield (a) higher levels of concern, (b) lower levels of persuasion knowledge, (c) a more positive attitude toward the recommended brand, and (d) greater adherence to the recommendation.

As previously discussed, users can interact with voice-controlled virtual assistants via a smart speaker or smartphone, and it remains to be seen whether these two ways differ with regard to concerns and persuasion levels. A direct comparison between smart speakers and smartphones is needed for at least two reasons. The first concerns external validity: interactions with the currently available virtual assistants can be either voice-based via smart speakers, voice-based via smartphones, or text-based on a smartphone screen. Second, if we were to only compare smart speakers to screen-based assistants, we would not know whether the effects are driven by a voice-based as opposed to a screen-based interface, or by the novelty of smart speakers as compared to smartphones. Developing specific expectations is, however, difficult: on the one hand, the novelty of smart speakers may affect people's concerns and persuasion levels, as indicated above. On the other hand, the fact that smartphones are highly personal devices that are often considered to be an extension of the self[40] may also influence concerns and persuasion levels. Our research question therefore is as follows:

RQ1: To what extent do voice-controlled interactions with a virtual assistant via either a smart speaker or a smartphone differ with regard to concerns and persuasion?

The Impact of Human Names

Another way in which social cues can manifest themselves in virtual assistants is through the name they are given. It is important to note that some leading platforms (e.g., Amazon, Apple, Google, and Microsoft) have provided their assistants with names that have arguably varying levels of ''humanness'' (e.g., Alexa, Cortana, Siri, Google Assistant), thus highlighting the importance of the name as a social cue that may influence subsequent responses, including concerns and persuasion.

In addition to the effects of different modalities, adopting a human name may function as an identity cue (i.e., it may affect whether the assistant is identified at the outset as human or bot)[41] and so evoke particular heuristics, for example, the so-called ''helper heuristic.'' Adopting a human name may influence trust and credibility and even give users the feeling that they are privileged in an otherwise technology-centered medium.[31] This may make people feel they have less cause for concern. In addition, as per the MAIN model, people may mindlessly rely on these cues without engaging in in-depth and critical processing of the content,[38,39] which could result in enhanced levels of persuasion. We propose, therefore, the following:

H2: A recommendation conveyed via a virtual assistant with a human name as opposed to no name will yield (a) lower levels of concern, (b) persuasion knowledge, (c) a more positive attitude toward the recommended brand, and (d) a greater adherence to the recommendation.

The Interaction of Voice and Human Name

According to the ''cue-cumulation effect,''[27] which is based on the rationale of the additivity hypothesis in dual-process persuasion models,[42] a combination of cues that are consistent with each other may yield stronger persuasion effects than only one cue.[43] In our case, if both social cues are present (i.e., voice and the adoption of a human name[38]), it is likely that the effects will be additive. Cue-cumulation effects have been identified in the context of IoT devices,[30] news websites,[27,43] and online review sites.[44] Therefore, we hypothesize the following:

H3: A virtual assistant with two social cues is more persuasive in terms of (a) brand attitudes and (b) adherence to the recommendation.

Method

Design and participants

The hypotheses were tested in a scenario-based online experiment with a 3 (voice-based via smart speaker, voice-based via smartphone, or text-based on a screen of a smartphone) × 2 (human name vs. the virtual assistant) between-subjects design. Scenario studies have proved useful in related fields like personalized communication.[45] The three versions of virtual assistants represent the different appearances of virtual assistants currently on the market and also allowed us to check whether the differences between a voice-controlled interface and a screen-based interface were driven by the type of device (smart speaker vs. smartphone or by the interface itself). The name Charlie was chosen because it is a name that is used for both men and women in the research country. This was deemed important given recent discussions on the role of gender in AI and smart speakers.[46]

The participants were recruited through an online panel of the research company Qualtrics. We excluded those who failed the attention and quality checks[47] and those who experienced technical problems. The final sample consisted of 180 participants (M_{age} 47.83, SD_{age} 15.22, 52.8 percent male).

Procedure

After providing informed consent, participants read a short scenario description for a minimum duration of 1 minute. This instructed participants to imagine that they had invited eight friends to dinner the following week and that they asked a virtual assistant for advice about the best brand of chocolate to buy to make a certain dessert. Chocolate was considered to be an appropriate product category because people often put cooking-related questions to search engines and virtual assistants, and use such assistants mainly for habitual purchases.[3,48] To enhance the realism of the scenario,[49] participants were shown a picture of the virtual assistant and received the recommendation either via a synthesized voice-clip with a female voice or via a picture of a smartphone screen (Fig. 1). The virtual assistant recommended a nonexistent brand in line with methodological recommendations to enhance the likelihood of finding persuasion effects.[47] Finally, participants completed a questionnaire measuring the dependent variables.

Measures

The measures used are listed in Table 1. Because no existing scale was available to measure concerns related to virtual assistants, we included a list of 12 possible concerns that were derived from academic and practitioner articles[12,13] (Table 2). The list shows a significant overlap with a recently published interview study on smart speakers.[14] Participants were asked to what extent they would be worried about these concerns when using the assistant at home. Response options ranged from 1 = not at all worried to 7 = very worried. A principal components analysis with Varimax rotation revealed two factors: one related to security concerns and one to concerns about autonomy. Gender, age, perceived

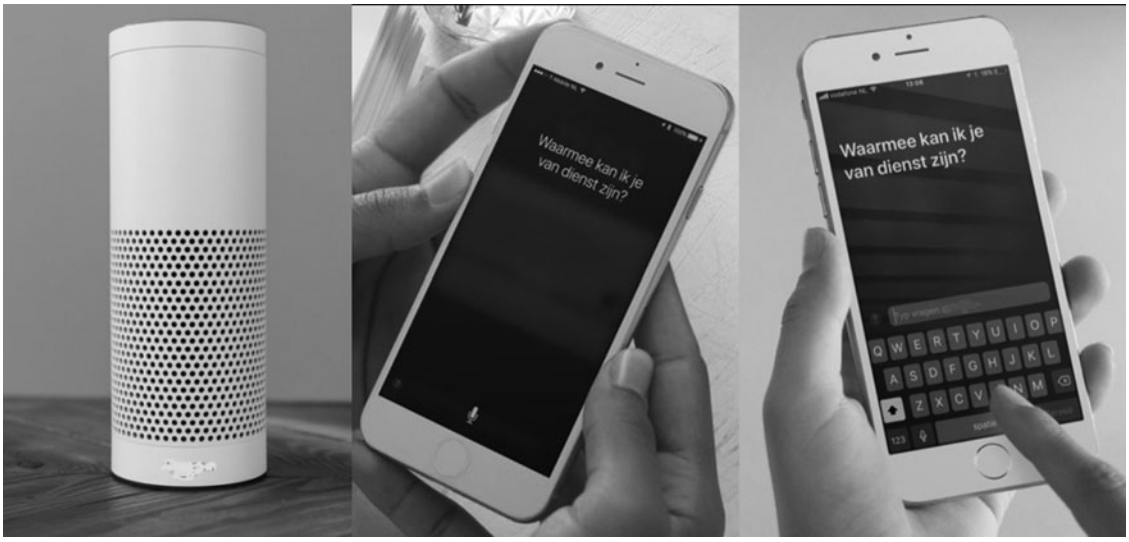

FIG. 1. Pictures of the experimental material. In the two smartphone conditions, the text displayed on the screen states: what can I help you with? In the voice-based via a smartphone condition **(B)** the recommendation was made via voice-only.[50] In the text based on a smartphone screen condition **(C)** the recommendation was made via text only. Because most currently available smart speakers **(A)** do not have a screen, we did not include such a version.

Table 1. Measurement of Dependent Variables

Variable	*Number of items*	*Type of scale*	*Example items*	*Statistics*	*Source*
Privacy concerns	7	1 = strongly disagree, 7 = strongly agree	When I use this virtual assistant: I am concerned about misuse of personal information. I feel fear that information may not be safe while stored	Cronbach's $\alpha = 0.91$; $M = 4.36$, $SD = 1.15$	[4,51]
Persuasion knowledge	4	1 = strongly disagree, 7 = strongly agree	The recommendation feels like an ad The brand Veraca paid to use this message	Cronbach's $\alpha = 0.88$, $M = 5.32$, $SD = 1.20$	[52]
Attitude toward the brand	4	Seven-point semantic differential scale	Bad/Good Unpleasant/Pleasant	Cronbach's $\alpha = 0.91$, $M = 4.27$, $SD = 1.00$	[53]
Adherence	3	1 = strongly disagree, 7 = strongly agree	I am likely to buy the recommended brand I am likely to buy the recommended amount of chocolate, \ I am likely to buy the type of chocolate that was recommended.	Cronbach's $\alpha = 0.81$, $M = 4.38$, $SD = 1.43$	Inspired by[54]
Involvement with virtual assistants	2	Seven-point semantic differential scale	very unimportant/very important very uninteresting/very interesting	$r = 0.856$, $p = 0.000$, $M = 3.18$, $SD = 1.65$	[24]

realism, and involvement with virtual assistants were measured as potential control variables.

Results

A series of two-way analyses of covariance were conducted. Involvement with virtual assistants was included as a covariate in all analyses because it was related to most of the independent variables (all $p < 0.01$). The results are summarized in Table 3.

Concerns

With regard to privacy concerns, the results showed neither a significant main effect of modality [$F(2, 173) = 2.24$, $p = 0.109$] nor a significant main effect of human name [$F(1, 173) = 0.81$, $p = 0.37$]. In addition, no significant interaction effect was found [$F(2, 173) = 0.58$, $p = 0.56$]. With regard to concerns about security, the results revealed a significant main effect of voice versus screen [$F(2, 173) = 5.06$, $p = 0.007$]. Concerns were highest among participants who were exposed to a voice-based recommendation via a smart speaker ($M = 5.14$, SE = 0.19). Participants in this condition were more concerned than in the voice-based smartphone condition ($M = 4.37$, SE = 0.16, Bonferroni: $p = 0.005$) and slightly more than in the text-based smartphone condition ($M = 4.66$, SE = 0.16 Bonferroni: ns). No main effect of human name was found [$F(1, 173) = 0.08$, $p = 0.78$] nor was there a significant interaction effect [$F(2, 173) = 0.09$, $p = 0.91$].

Table 2. Rotated Component Matrix of Items Used to Measure Concerns about Virtual Assistants

When I would use this virtual assistant in my own home I would be worried that:…

	Concerns about security	*Concerns about autonomy*
…the data that the virtual assistants collect would be leaked	0.887	0.167
…a profile will be made of me	0.844	0.082
…the virtual assistant would listen to my conversations,	0.830	0.162
…my credentials would be stolen	0.809	0.202
…marketers get to know too much about me	0.806	0.252
…the virtual assistant would be hacked	0.803	0.219
…someone can watch or listen to me	0.773	0.293
…marketers and advertisers will try to influence me.	0.740	0.288
…the virtual assistant would make images of me	0.738	0.337
…the virtual assistant would influence my decisions	0.147	0.923
…I would get dependent on the virtual assistant	0.187	0.906
…the virtual assistant influenced my freedom of choice	0.357	0.767
	EV = 7,089 R^2 = 59,076; Cronbach's $\alpha = 0.94$, $M = 4.68$, $SD = 1.34$	EV = 1.68, R^2 = 13.99; Cronbach's $\alpha = 0.88$, $M = 3.72$, $SD = 1.55$

Table 3. Summary of the Results

	Concerns			*Persuasion*		
	Privacy concerns	*Concerns about security*	*Concerns about autonomy*	*Persuasion knowledge*	*Brand attitude*	*Adherence to recommendation*
Voice vs. screen[a]	ns	Voice-based via smart speaker > voice-based via smartphone	ns	Text-based via smartphone screen > voice-based via smartphone	ns	Text-based via smartphone screen > voice-based via smart speaker
Human name	ns	ns	Human name < no name	Human name > no name[b]	Human name > no name	Human name > no name
Human name vs. voice	ns	ns	ns	ns	ns	ns

[a]Only comparisons that were significantly different in a *post hoc* Bonferroni test are displayed.
[b]Marginally significant.
ns, not significant.

With regard to concerns about autonomy, a main effect of human name was significant [$F(1, 173) = 5.42$, $p = 0.021$]. Participants were more concerned that the virtual assistant would influence their freedom of choice when the assistant did not have a human name ($M = 4.02$, SE = 0.16) than when it had a name ($M = 3.48$, SE = 0.17). The results showed neither a main effect of modality [$F(2, 173) = 2.06$, $p = 0.13$] nor a significant interaction effect [$F(1, 173) = 0.44$, $p = 0.64$].

Persuasion

For persuasion knowledge, a significant main effect of voice versus screen was found: [$F(2, 173) = 3.43$, $p = 0.034$]. Participants were most aware that the recommendation was a persuasive attempt when it was presented on a smartphone screen ($M = 5.57$, SE = 0.14). *Post hoc* Bonferroni tests showed that this condition differed significantly from the voice-based via smartphone condition ($M = 5.08$, SE = 0.130, $p = 0.029$) but not from the voice-based smart speaker condition ($M = 5.35$, SE = 0.16). Further, a marginally significant main effect of human name was found [$F(1, 173) = 2.95$, $p = 0.088$]. Participants who were exposed to a virtual assistant with a human name were slightly more aware that the recommendation was sponsored by a brand ($M = 5.47$, SE = 0.12) than participants in the condition without a human name ($M = 5.19$, SE = 0.11). The interaction effect was not significant [$F(2, 173) = 0.34$, $p = 0.71$].

The analysis also showed a main effect of human name on brand attitude [$F(1, 173) = 5.62, = <0.019$]. Participants who were exposed to the virtual assistant with a human name evaluated the brand more positively ($M = 4.44$, SE = 0.10) than the participants who saw an assistant without a human name ($M = 4.11$, SE = 0.10). No main effect of modality [$F(2, 173) = 0.66$, $p = 0.52$] was found nor was there an interaction effect [$F(2, 173) = 1.83$, $p = 0.16$].

With regard to adherence to the recommendation, a main effect of voice versus screen was found [$F(2, 173) = 3.64$, $p = 0.028$]. Participants were most likely to adhere to the recommendation when it was made via a smartphone screen ($M = 4.63$, SE = 0.17) as opposed to voice-based via a smart speaker ($M = 3.97$, SE = 0.19, Bonferroni: $p = 0.029$). The condition in which participants were exposed to a voice-based recommendation via a smartphone ($M = 4.47$, SE = 0.16) did not differ from the other conditions but was closer to the text-based recommendation via the smartphone screen condition than the voice-based smart speaker condition. In addition, the results showed a main effect of human name [$F(1, 173) = 4.20$, $p = 0.042$]. Participants were more likely to adhere to the recommendation when the assistant had a human name ($M = 4.56$, SE = 0.14) than when it did not ($M = 4.15$, SE = 0.14). The interaction effect was insignificant [$F(2, 173) = 2.14$, $p = 0.12$].

The mediating role of concerns and persuasion knowledge

Before formally testing mediation, we first checked whether concerns and persuasion knowledge were correlated with brand attitude and adherence. Results showed a significant correlation only between concerns about security and brand attitude ($r = -0.210$, $p = 0.005$), and between persuasion knowledge, brand attitude and adherence ($r = -0.190$, $p = 0.011$ and $r = -0.164$, $p = 0.028$). Subsequently, we conducted a mediation analysis for these variables with the Hayes PROCESS macro (v.3,[54] model 4).[a] Results showed no significant indirect effects (Table 4).

Discussion

This study aimed to test how the modality of a virtual assistant (voice vs. screen) and the adoption of a human name can influence people's concerns about privacy, security, autonomy, and persuasive outcomes. The results showed that both cues played an important role.

The first major finding was that the modality through which a virtual assistant provided recommendations influenced both persuasiveness and concerns. We showed that people's responses differ between assistants with voice and screen interfaces. In line with our expectations, persuasion knowledge was lower for voice- than for screen-based interactions. Contrary to our expectations, adherence to recommendations was highest when the recommendation was made via a smartphone screen. The novelty of voice speakers may mean that people are more willing to accept their recommendations than those received via screen-based interfaces. This is further illustrated by our findings that security concerns were highest among participants who were exposed to voice recommendations on a smart speaker and by the

Table 4. Results of the Mediation Analyses

Independent variable	*Mediator*	*Dependent variable*	*B*	*SE*	*95% CI*
Modality^{X1}	Concerns about security	Brand attitude	0.085	0.055	–0.012 to 0.20
Modality^{X2}	Concerns about security	Brand attitude	0.053	0.044	–0.012 to 0.159
Modality^{X1}	Persuasion knowledge	Brand attitude	0.0178	0.027	–0.023 to 0.083
Modality^{X2}	Persuasion knowledge	Brand attitude	–0.0138	0.025	–0.078 to 0.021
Modality^{X1}	Persuasion knowledge	Adherence	0.013	0.033	–0.049 to 0.093
Modality^{X2}	Persuasion knowledge	Adherence	–0.010	0.028	–0.083 to 0.037
Human name	Concerns about security	Brand attitude	–0.006	0.023	–0.052 to 0.046
Human name	Persuasion knowledge	Brand attitude	0.020	0.023	–0.015 to 0.076
Human name	Persuasion knowledge	Adherence	0.017	0.028	–0.037 to 0.078

^{X1,2}Based on indicator coding with voice-based via a smart speaker as reference category (0); voice-based via a smartphone = 1 in X1, and text-based via a smartphone screen = 1 in X2. We reported simple mediation analyses instead of moderated mediation analyses because the interaction between modality and human name was nonsignificant.

CI, confidence interval.

findings of a recent interview study showing that users of smart speakers would feel uncomfortable if their smart speaker voice commands were used to target adverts.[14] This finding also extends previous recent findings that the modality (voice vs. screen) of a virtual assistant influences the perceived human-likeness of the assistant,[37] whether people feel comfortable using an assistant,[56] and the ease of understanding the information provided[57] by showing that modality also influences concerns that people may have, and the persuasiveness of the assistant.

A second major finding was that merely giving the virtual assistant a human name influenced persuasion levels. Participants were more likely to follow the recommendation, have a more positive brand attitude, and were more aware of persuasive intent when the assistant had a human name than when it did not. In addition, participants were less concerned that the virtual assistant would influence their autonomy. This finding is an important theoretical contribution as the study is the first to show that merely giving a human-like name to a virtual assistant can influence persuasive outcomes. This provides a new level of insight into theories on persuasion knowledge[16] and ''hidden'' persuasion.[17–19] Although giving a name to an assistant leads users to see through the persuasive intent of a recommendation, it does not protect them against being persuaded. This is contrary to the traditional idea that more persuasion knowledge leads to less persuasion.[16] This finding emphasizes that persuasion via virtual assistants is different from other forms of hidden persuasion (e.g., more novel, more personalized), and can be seen as preliminary empirical support to the helper heuristic notion.[58]

A third major finding was that the results did not provide support for a cue-cumulation effect.[27] It seems that the social cues worked independently of each other. A potential explanation is that the influence of modality goes beyond the influence of voice. Voice versus screen has implications for the functionality of a virtual assistant and the way it is operated. This is in line with recent work on interface psychology showing that different interfaces change the attributes that people use when they buy products via these interfaces.[59] Adoption of a human name mostly relates to how people perceive the assistant and its intents rather than its functionality. The finding that a human name leads to fewer concerns about the influence a virtual assistant might have on their decisions is an indication that a human name has served as a real anthropomorphic cue to trigger superficial processing.[38,39,41] This finding adds empirical evidence to existing literature suggesting that anthropomorphic cues serve as heuristics in the persuasion process.[38,39]

Conclusion

This study sheds light on how social cues used in virtual assistants can influence people's concerns and persuasion levels by showing that both name and modality influence consumer responses. As virtual assistants play an increasingly important role across multiple everyday environments and contexts, blurring the boundary between the physical and the virtual,[2] these findings hold important implications for future research, and for advertisers and consumer policies.

The findings imply that assistants with a human name may be more effective in promoting products. This provides implications for advertisers when considering which virtual assistant platforms to use (e.g., Amazon's Alexa or Google's Assistant) or the naming strategy for their own agents (e.g., chatbots). It also provides insights for policymakers when it comes to the persuasive potential of these assistants. The findings highlight that modality matters for security concerns, with smart speakers creating the greatest concern. This suggests that the producers of smart speakers need to enhance security and be more transparent about their practices (e.g., see Lau et al.[14]). Consumer policymakers should also inform consumers about how they can protect themselves.

Note

a. We also conducted three moderated mediation analyses (Model 7) for these variables but again no significant indirect effects were found.

Author Disclosure Statement

No competing financial interests exist.

Funding Information

This study was funded by the Amsterdam School of Communication Research, University of Amsterdam.

References

1. Hoy MB. Alexa, Siri, Cortana, and more: an introduction to voice assistants. Medical Reference Services Quarterly 2018; 37:81–88.

2. Gaggioli A. Virtual personal assistants: an emerging trend in artificial intelligence. Cyberpsychology. Behavior, and Social Networking 2018; 21:803–804.
3. Moriuchi E. Okay, Google!: an empirical study on voice assistants on consumer engagement and loyalty. Psychology & Marketing 2019; 36:489–501.
4. Kim D, Park K, ParkY, et al. Alexa, Tell Me More: The Effect of Advertisements on Memory Accuracy from Smart Speakers. PACIS 2018 Proceedings. 204. https://aisel.aisnet.org/pacis2018/204 (accessed June 24, 2020).
5. Guzman AL. Voices in and of the machine: source orientation toward mobile virtual assistants. Computers in Human Behavior 2019; 90:343–350.
6. Zanbaka C, Goolkasian P, Hodges L. (2006) Can a virtual cat persuade you?: the role of gender and realism in speaker persuasiveness. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems.* Montreal, QC, Canada: ACM, pp. 1153–1162.
7. Nass C, Moon Y. Machines and mindlessness: social responses to computers. Journal of Social Issues 2000; 56:81–103.
8. Reeves B, Nass C. (1996) *How people treat computers, television, and new media like real people and places*. Cambridge, UK: CSLI Publications and Cambridge University Press.
9. Xu K, Lombard M. Persuasive computing: feeling peer pressure from multiple computer agents. Computers in Human Behavior 2017; 4:152–162.
10. Araujo T. Living up to the chatbot hype: the influence of anthropomorphic design cues and communicative agency framing on conversational agent and company perceptions. Computers in Human Behavior 2018; 85:183–189.
11. Shi SW, Kalyanam K. Touchable apps: exploring the usage of touch features and their impact on engagement. Journal of Interactive Marketing 2018; 44:43–59.
12. Weinberg BD Milne GR Andonova YG, et al. Internet of Things: convenience vs. privacy and secrecy. Business Horizons 2015; 58:615–624.
13. eMarketer. (2017) Concerns that Internet users in select countries in Western Europe have about using voice assistants. www.emarketer.com/Chart/Concerns-that-Internet-Users-Select-Countries-Western-Europe-Have-About-Using-Voice-Assistants-Nov-2017-of-respondents/219346 (accessed June 24, 2020).
14. Lau J, Zimmerman B, Schaub F. Alexa, are you listening?: privacy perceptions, concerns and privacy-seeking behaviors with smart speakers. Proceedings of the ACM on Human-Computer Interaction 2018; 2(CSCW):102.
15. Diao W, Liu X, Zhou Z, et al. (2014) Your voice assistant is mine: how to abuse speakers to steal information and control your phone. In *Proceedings of the 4th ACM Workshop on Security and Privacy in Smartphones & Mobile Devices*. ACM, pp. 63–74.
16. Friestad M, Wright P. The persuasion knowledge model: how people cope with persuasion attempts. Journal of Consumer Research 1994; 21:1–31.
17. Boerman SC, Kruikemeier S. Zuiderveen Borgesius FJ Online behavioral advertising: a literature review and research agenda. Journal of Advertising 2017; 46:363–376.
18. Strycharz J, van Noort G, Smit E, et al. Protective behavior against personalized ads: motivation to turn personalization off. Cyberpsychology: Journal of Psychosocial Research on Cyberspace 2019; 13: Article 1.
19. Aguirre E, Roggeveen AL, Grewal D, et al. The personalization-privacy paradox: implications for new media. Journal of Consumer Marketing 2016; 33:98–110.
20. Boerman SC, Willemsen LM, Van Der Aa EP. ''This post is sponsored'': effects of sponsorship disclosure on persuasion knowledge and electronic word of mouth in the context of Facebook. Journal of Interactive Marketing 2017; 38:82–92.
21. Van Reijmersdal EA, Boerman SC, Buijzen M, et al. This is advertising! Effects of disclosing television brand placement on adolescents. Journal of Youth and Adolescence 2017; 46:328–342.
22. Tutaj K, van Reijmersdal EA. Effects of online advertising format and persuasion knowledge on audience reactions. Journal of Marketing Communications 2012; 18:5–18.
23. Edell JA. (1998) Non-verbal effects in Ads: a review and synthesis. In: Hecker S Stewart DW, eds. *Nonverbal communication in advertising*. Lexington, MA: Lexington Books, pp. 11–27.
24. Dijkstra M, Buijtels HE, Van Raaij WF. Separate and joint effects of medium type on consumer responses: a comparison of television, print, and the Internet. Journal of Business Research 2005; 58:377–386.
25. Posner MI, Nissen MJ, Klein R. Visual dominance: an information processing account of its origins and significance. Psychological Review 1976; 83:157–171.
26. Jacoby J, Hoyer WD, Zimmer MR. To read, view, or listen? A cross-media comparison of comprehension. Current Issues and Research in Advertising 1983; 6:201–217.
27. Sundar SS, Knobloch-Westerwick S, Hastall MR. News cues: information scent and cognitive heuristics. Journal of the American Society for Information Science and Technology 2007; 58:366–378.
28. Shannon CE, Weaver W. (1963) *The mathematical theory of communication*. Urbana, IL: University of Illinois Press.
29. Berlo DK. (1965) *The process of communication; an introduction to theory and practice*. New York: Holt, Rinehart and Winston.
30. Kim KJ. Interacting socially with the Internet of Things (IoT): effects of source attribution and specialization in human–IoT interaction. Journal of Computer-Mediated Communication 2016; 21:420–435.
31. Zhao S. Humanoid social robots as a medium of communication. New Media & Society 2006; 8:401–419.
32. Guzman AL, Lewis SC. Artificial intelligence and communication: A Human–Machine Communication research agenda. New Media & Society, 2019; 22:70–86.
33. Sundar SS, Nass C, Source orientation in human-computer interaction: programmer networker or independent social actor. Communication Research 2000; 27:683–703.
34. Nass C, Steuer J. Voices boxes and sources of messages: computers and social actors. Human Communication Research 1993; 19:504–527.
35. Nass C, Steuer J, Tauber ER. (1994) Computers are social actors. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. Boston: ACM, pp. 72–78.
36. Cohen MH, Cohen MH, Giangola JP, et al. (2004) *Voice user interface design*. Boston: Addison-Wesley Professional.
37. Cho E, Molina MD, Wang J. The effects of modality, device, and task differences on perceived human likeness of voice-activated virtual assistants. Cyberpsychology, Behavior, and Social Networking 2019; 22:515–520.
38. Sundar SS. (2008).The MAIN Model: a heuristic approach to understanding technology effects on credibility.

In Metzger MJ, Flanagin AJ, eds. *Digital media youth and credibility*. Cambridge, MA: The MIT Press, pp. 72–100.
39. Kim KJ, Sundar SS. Mobile persuasion: can screen size and presentation mode make a difference to trust? Human Communication Research 2016; 42:45–70.
40. Han S, Kim KJ, Kim JH. Understanding nomophobia: Structural equation modeling and semantic network analysis of smartphone separation anxiety. Cyberpsychology Behavior and Social Networking 2017; 20:419–427.
41. Go E, Sundar SS. Humanizing chatbots: the effects of visual, identity and conversational cues on humanness perceptions. Computers in Human Behavior 2019; 97:304–316.
42. Chaiken S, Trope Y. (1999) Dual-process theories in social psychology. New York: Guilford Press, 1999.
43. Xu Q. Social recommendation source credibility and recency: effects of news cues in a social bookmarking website. Journalism & Mass Communication Quarterly 2013; 90:757–775.
44. Lim YS, Van Der Heide B. Evaluating the wisdom of strangers: the perceived credibility of online consumer reviews on Yelp. Journal of Computer-Mediated Communication 2014; 20:67–82.
45. Bol N, Dienlin T, Kruikemeier S, et al. Understanding the effects of personalization as a privacy calculus: analyzing self-disclosure across health, news, and commerce contexts. Journal of Computer-Mediated Communication 2018; 23:370–388.
46. Kim A, Cho M, Sung AJ. Effects of gender and relationship type on the response to artificial intelligence. Cyberpsychology, Behavior, and Social Networking 2019; 22:249–253.
47. Geuens M, De Pelsmacker P. Planning and conducting experimental advertising research and questionnaire design. Journal of Advertising 2017; 46:83–100.
48. Rabideau C. (2018). 8 things you didn't know Amazon Alexa could do in the kitchen. Reviewed USA Today. https://www.reviewed.com/smarthome/features/8-things-you-didnt-know-amazon-alexa-could-do-in-the-kitchen (accessed June 24, 2020).
49. Atzmüller C, Steiner PM. Experimental vignette studies in survey research. Methodology. European Journal of Research Methods for the Behavioral and Social Sciences 2010; 6:128–138.
50. iCulture. This is how you prevent Siri from reacting to ''hey Siri.'' https://www.iculture.nl/tips/he-siri-uitschakelen-iphone-ipad-mac/ (accessed June 18, 2020).
51. Baek TH, Morimoto M. Stay away from me. Journal of Advertising 2012; 41:59–76.
52. Kruikemeier S, Sezgin M, Boerman SC. Political microtargeting: relationship between personalized advertising on Facebook and Voters' responses. Cyberpsychology Behavior and Social Networking 2016; 19:367–372.
53. Chang Y, Thorson E. Television and web advertising synergies. Journal of Advertising 2004; 33:75–84.
54. Li C. When does web-based personalization really work? The distinction between actual personalization and perceived personalization. Computers in Human Behavior 2016; 54:25–33.
55. Hayes AF. Introduction to mediation, moderation, and conditional process analysis: a regression-based approach. New York: Guilford Publications, 2017.
56. Moorthy AE, Vu K-PL. Privacy concerns for use of voice activated personal assistant in the public space. International Journal of Human–Computer Interaction 2015; 31: 307–335.
57. Berry DC, Butler LT, de Rosis F. Evaluating a realistic agent in an advice-giving task. International Journal of Human–Computer Studies 2005; 63:304–327.
58. Kim KJ, Park E, Sundar SS. Caregiving role in human–robot interaction: a study of the mediating effects of perceived benefit and social presence. Computers in Human Behavior 2013; 29:1799–1806.
59. Brasel SA, Gips J. Interface psychology: touchscreens change attribute importance, decision criteria, and behavior in online choice. Cyberpsychology, Behavior, and Social Networking 2015; 18:534–538.

Address correspondence to:
Dr. Hilde A.M. Voorveld
Amsterdam School of Communication Research
University of Amsterdam
P.O. Box 15793
Amsterdam 1001 NG
Netherlands

E-mail: h.a.m.voorveld@uva.nl