
“Alexa is my new BFF”: Social Roles, User Satisfaction, and Personification of the Amazon Echo

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Abstract

Amazon’s Echo and its conversational agent Alexa open exciting opportunities for understanding how people perceive and interact with virtual agents. Drawing from user reviews of the Echo posted to Amazon.com, this case study explores the degree to which user reviews indicate personification of the device, sociability level of interactions, factors linked with personification, and influences on user satisfaction. Results indicate marked variance in how people refer to the device, with over half using the personified name Alexa but most referencing the device with object pronouns. Degree of device personification is linked with sociability of interactions: greater personification co-occurs with more social interactions with the Echo. Reviewers mentioning multiple member households are more likely to personify the device than reviewers mentioning living alone. Even after controlling for technical issues, personification predicts user satisfaction with the Echo.

Author Keywords

Conversational agent; Amazon Echo; personification; social robots.

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous

Introduction

With recent advances in technology, embodied virtual agents are becoming integrated into daily life. The popularity of devices like the Amazon Echo, equipped with social agent Alexa, has provided researchers and designers with new opportunities to study how people perceive and respond to such conversational agents. The potential of the Echo to take on a range of different roles and functions in multi-user interactions, especially in personal spaces such as the home, makes this device particularly relevant for study. There remains a dearth of empirical research on the social uses of these devices and the implications of interactions with them.

This study investigates how people perceive, interact with, and integrate this device into social life through a case study of Amazon customer reviews. In particular, we draw on the Computers as Social Actors (CASA) paradigm [14] to understand users' experiences and their social construction of this technology. According to the CASA paradigm, people respond to technologies as though they were human, despite knowing that they are interacting with a machine [14]. Thus, people ascribe personalities to computers [13] and even apply politeness norms to these interactions [12].

Particularly relevant to conversational agents is the finding that people's perceptions of a machine-generated voice are influenced by its human-like personality traits. For example, participants felt stronger social presence when they heard machine-generated voices similar to their own or with

extroverted personalities compared to dissimilar voices or introverted personalities [7]. Overall, speech functionality is an essential feature of conversational agents, as it enables anthropomorphic interactions with assistive technologies, thus encouraging socialization and perceptions of these devices as social actors [15].

The Amazon Echo has several affordances that predispose users to personifying it and integrating it into social life. First, to operate the device, users must interact with Alexa, the conversational agent. Thus, the Echo is inherently a *socially interactive* device, since it requires social interaction to function [3]. Alexa is also personified, in that the agent is endowed with a name, gender, and a personality. Such design choices encourage users to anthropomorphize the device; unlike the mindless response described by Nass, anthropomorphism is a conscious mechanism wherein people infer that a non-human entity has human-like characteristics and warrants human-like treatment [11;4]. It is also programmed with the ability to interact in a playful way, making the device seem more engaging and intelligent [9]. Finally, the Echo is embodied and is co-located with users, and can alter the dynamics of its surrounding environment.

The above characteristics are designed to afford social functionalities and promote anthropomorphism. However, research is still required to determine how interactions with such devices unfold in real-world social settings, and the types of roles and functions they fulfill for users. We report a case study examining a series of questions through the analysis of users' reviews posted on Amazon. Specifically, three primary questions were investigated: (1) How do users perceive and respond to this device?, (2) What factors predict

Degree of Sociability Codes and Examples

Source of information,
news/weather, and facts

*I use it to check the weather
and the news.*

Provider of entertainment:
playing music, audio books
and games; telling jokes

*It's very entertaining - it
plays songs, and tells jokes.*

Assistant managing shopping,
schedules, and timers/alarms

*She helps me keep schedules
and grocery lists.*

Companion, conversation
partner, or other entity that
listens and speaks

I talk to Alexa all the time.

Friend, family member,
roommate, or spouse

*Alexa is like a member of the
family.*

Alexa is my new BFF.

Table 1: Coding categories for
degree of sociability and
exemplifying quotes.

when users are more likely to personify the device?, and (3) How are evaluations of the device influenced by degrees of personification or interaction sociability, and by technical qualities and integration with other services? The results illuminate emergent communicative and behavioral practices in interactions with embodied virtual agents, and how these agents may be used to support social interactions.

Methods

Data Collection

A total of 851 Amazon.com [1] reviews of the full-sized Echo device were collected from two weeks in December 2016. These reviews provide an unsolicited evaluation of the Echo device and Alexa agent, and are a potentially rich source of descriptions of its uses. Content analysis of web reviews has been used effectively to understand reviewer opinions, both on Amazon and on other sites [e.g., 8,10]. Star ratings were collected and gender of the reviewer was inferred based on the username. No identifying information about reviewers was documented. Though reviews are publicly available and written for unknown others, quotations in the present work are paraphrased to ensure reviewer privacy while maintaining meaning.

Content Analysis

Reviews were checked to ensure they were related to the actual experience of using Echo/Alexa. Reviews that were short or un-descriptive (e.g., "Good product. Came on time.") were excluded from further coding. The remaining reviews ($N=587$, 69%) were coded using the categories described below; due to resource constraints only 27% of them were coded by a second coder. The focus on personification and sociability was based on

the CASA paradigm [14], but specific themes were derived from early coding.

Degree of personification. The extent to which the technology was personified was operationalized as a continuum based on whether the review text described the technology as a person (using the name Alexa or personal pronouns such as "her"), as an object (Echo; the pronoun "it"), or both (i.e., both "her" and "it"). Intercoder reliability for name personification (Cohen's $\kappa=0.88$) and pronoun personification (Cohen's $\kappa=0.90$) was acceptable.

Degree of sociability. An open coding process was used to generate codes that reflected the degree of sociability ascribed to Alexa/Echo through reviewer descriptions of its functions and roles. Reviewers' uses of Alexa/Echo fell into five main categories, on a continuum from least sociable to most sociable functions or roles (Table 1). Intercoder reliability for degree of sociability was acceptable (Cohen's $\kappa=0.83$).

Integration. A major advertised use of the Echo is its ability to integrate with other technologies and services [1]. To assess whether personification of Alexa/Echo is associated with how integrated it is with users' other technologies, reviews were also coded for mentions of other smart devices or services, including other Amazon devices (Dot, Tap, or additional Echos), integration with services (Amazon Prime, streaming music, etc.), and smart or connected home devices (smart home hubs, lights, thermostats, speakers).

Technical qualities and issues. Personification and satisfaction with the device may depend on its ability to perform tasks as advertised – serving as a speaker with

Name Personification		
Echo only	122	37.2%
Echo & Alexa	57	17.4%
Alexa only	149	45.4%

Table 2: Frequency of name (Echo/Alexa) personification levels

Pronoun Personification		
Object only	307	73.4%
Both	48	11.5%
Person only	63	15.1%

Table 3: Frequency pronoun (it/her) personification levels

Overall Personification		
No personification	257	51.1%
Some personification	148	29.4%
All personification	98	19.5%

Table 4: Frequency of overall personification levels

voice recognition technology and intelligent responses [9,16]. We noted reviewers' mentions of speaker or sound quality and voice recognition capabilities. The appropriateness or effectiveness of Alexa's responses was also captured. Other issues related to general functioning of the device were also noted.

Household characteristics. We coded if the reviewer mentioned (1) being part of a family or living with another, (2) having children or grandchildren, (3) being elderly or having an elderly person in the home, (4) being disabled or having a disabled person in the home, and (5) using the device in a non-home setting.

Results

After eliminating undetailed reviews or those unrelated to use of the Echo/Alexa, as described above, the remaining 587 reviews were very favorable, with a mean star rating of 4.32 ($SD=1.17$), on a one- to five-star scale. Reviewer gender was not discernable for most of these reviews ($n=260$); when gender could be inferred, most reviewers appeared to be male ($n=200$).

Perceptions and Interactions

Nearly all of the reviews kept for analysis contained some language that could be coded for degree of personification ($n=503$, 86%). When reviewers mentioned the device by name ($n=328$), a slight majority used Alexa, with fewer using Echo or both names in a single review (Table 2). In contrast, of the reviews containing pronouns referencing the technology ($n=418$), the majority used object pronouns, with far fewer using solely person pronouns or both object and person pronouns (Table 3). There is a small, positive correlation between degree of name and pronoun personification ($r=0.21$, $n=587$, $p<.001$). Combining

these two variables such that exclusive use of Echo and/or object pronouns is the lowest level (no personification at all), exclusive use of Alexa and/or person pronouns is the highest level (all personification), and a mix of object and person references is the mid-level (some personification) yields a continuum of increasing degree of personification. Frequencies and percentages of all reviews containing language coded for degree of personification ($n=503$) are reported in Table 4.

The open coding of user descriptions of interactions with the Amazon Echo yielded five categories of interactions, on a continuum from least sociable (providing information such as news or weather and facts) to most sociable (friend, family member, roommate, or spouse). Of the 587 reviews kept for analysis, 347 (59%) could be assigned to one of these categories. Most reviewers described a single category from the continuum of sociability ($n=189$), some indicated two categories ($n=104$), and few indicated three ($n=52$) or four ($n=4$). The most common category was entertainment, at level 2 on the continuum (Table 5). When more than one category was mentioned, highest level of sociability was recorded and used for subsequent analyses.

Predictors of Personification

A one-way Analysis of Variance (ANOVA) revealed a significant association between name personification and level of sociability: $F(3, 343)=12.82$, $p<.001$. A similar result was found for pronoun personification ($F(3, 343)=11.79$, $p<.001$), as well as combined personification ($F(3, 343)=20.84$, $p<.001$) on the level of sociability. Users calling their device Alexa and using person pronouns are more likely to fall into higher

Frequency of Interaction Type		
Info	135	38.9%
Entertainment	274	79.0%
Assistant	116	33.4%
Companion	19	5.5%
Friend	25	7.2%

Table 5: Frequency of interaction types. Reviews can have more than one interaction type.

Frequency of Household Type		
Single member	258	57.7%
Unspecified others	124	27.7%
Children	50	11.2%
Elderly	10	2.3%
Disabled	4	0.9%
Non-home	3	0.6%

Table 6: Frequency of household type.

sociability categories compared to reviewers who use the name Echo and object pronouns.

Of the 587 reviews kept for analysis, 447 (76.15%) made some reference to members of the household. The plurality of these made reference only to the self, and the next most frequent reference was an undetailed indication of other household members (e.g., “we use it a lot”). Other reviewers specifically mentioned children in the household, being elderly or having an elderly person in the home, being disabled or having a disabled person in the home, or using the device in a non-home setting, including a school classroom, office, or dorm room (Table 6). Categories with few instances were collapsed, yielding a single variable with three categories for household type: single, multi-member family (mentions of unspecified family members and children), or special populations (elderly and/or disabled). Non-home users were excluded. A one-way ANOVA found a significant effect of household type on personification, such that households with children or other family members who interact with the Echo are more likely to personify the technology than single users or special populations: $F(2, 411)=7.23, p=.001$. Household type did not have a statistically significant effect on sociability of interaction: $F(2, 272)=1.91, p=.15$.

Influences on Satisfaction

Star ratings accompany each review and offer a straightforward metric of reviewer satisfaction with the Amazon Echo. We explored how star ratings are influenced by degree of personification, sociability of interaction, technical issues, and integration with other devices and services through a linear regression model ($R^2=.17, p<.001$). The dependent variable of user

evaluations was log-transformed to reduce left skewness. Reviewers who mentioned technical issues, such as problems with general functionality ($\beta= -.16, SE=.07, t(298)= -3.02, p=.003$) or appropriateness of responses to their commands ($\beta= -.25, SE=.06, t(298)= -4.34, p<.001$), were less satisfied with the device. More personification predicted greater satisfaction ($\beta=.15, SE=.03, t(298)=2.51, p=.012$), even after controlling for technical issues. All other variables included in the model were non-significant.

Discussion

Amazon.com reviews of the Amazon Echo suggest variations in how people refer to the technology, with over half using the personified name Alexa, but most referencing the technology with object pronouns. When name and pronoun are considered together, users are nearly evenly split between no personification and at least some personification, though almost twenty percent commit to exclusive personification language. These results suggest the extent of personification varies among users, prompting further inquiry into factors, e.g., people’s expectations and mental models of social robots [6] that explain the process of personification and differences among users.

Most descriptions of interactions with Echo/Alexa suggest low- to mid-level sociability. Specifically, most users describe interacting with the technology for entertainment purposes (such as playing music) or for its assistant functions (managing scheduling or shopping), uses that involve a moderate degree of sociability. However, reviewers who exclusively use the personified name Alexa and person pronouns in their reviews are more likely to report having sociable interactions with the device compared to reviewers who

use the name Echo and object pronouns. Thus, there is a positive association between more sociable uses of the device and greater personification. Future research should explore causality in the relationship between interaction type and degree of personification.

Users whose reviews indicate children or others are in the household interacting with Echo/Alexa are more likely to personify the device, using the name Alexa and person pronouns more often than those reviewers mentioning only the self as a user or special populations (e.g., elderly or disabled), although we had limited data to draw from for family composition. This finding implies that embodied conversational agents may become anthropomorphized when they are integrated into multi-member more than in single-person households. Our results suggest that Alexa/Echo may be more personified when situated within other social relationships, like families. The unique role of a conversational agent in different household types should be explored in future research.

Personification of the device also plays a role in user satisfaction. Personification of Alexa is associated with increased levels of satisfaction, regardless of technological problems or function of the device. Simply put, people who love *her*, love the Echo.

The finding that people tend to personify Alexa is in line with the CASA paradigm, since people tend to use human scripts to interact with technologies that exhibit human-like social cues. Future research should explore personification of conversational agents in devices like the Echo, in which the agent is the only interface, compared to other multi-interface devices with a conversational agent (e.g. Siri). Future research should

also explore whether people personify the device consciously or non-consciously, and how system and context characteristics, such as single- vs. multi-interface, private vs. public settings in which a device is used [9], the perceived intelligence of the system [9], and its affective and communicative capabilities [5, 2], influence personification and socialization.

The link between personification and satisfaction is particularly interesting: Does satisfaction with the device lead to personification, or are people who personify the device more likely to be satisfied with its performance? Further research is required to understand how the personification of social agents may affect user satisfaction and, consequently, drive the adoption of social technologies in settings such as the home.

These findings reveal emergent social uses and functions of Amazon's Echo/Alexa, but their generalizability is limited by the sample of self-selected users who chose to post reviews, as they may differ in meaningful ways from those who did not. However, the findings of this exploratory study offer insight into how people socially construct, anthropomorphize, and interact with the Amazon Echo as a social and conversational agent. Although users vary greatly in how they personify the device, our findings point to the promise of personified technologies, in that users find satisfaction with devices they can interact with socially.

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References

1. Amazon Echo. Amazon.com. Retrieved December 19, 2016 from <https://www.amazon.com/Amazon-Echo-Bluetooth-Speaker-with-WiFi-Alexa/dp/B00X4WHP5E>
2. Phil Cohen, Adam Cheyer, Eric Horvitz, Rana E. Kaliouby, and Steve Whittaker. 2016. On the future of personal assistants. In *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems (CHI'16)*, 1032-1037.
3. Terrence Fong, Illah Nourbakhsh, and Kerstin Dautenhahn. 2003. A survey of socially interactive robots. *Robotics Autonomous Sys* 42, 3: 143-166.
4. Chad Gonnerman. 2008. Examining the how and why of anthropomorphism. *Metascience* 17, 3: 419-423.
5. Malte F. Jung. 2017. Affective grounding in human-robot interaction. In *Proceedings of the Twelfth ACM/IEEE International Conference on Human-Robot Interaction*. IEEE.
6. Minae Kwon, Malte F. Jung, and Ross A. Knepper. Human expectations of social robots. 2016. In *Proceedings the Eleventh ACM/IEEE International Conference on Human Robot Interaction (HRI '16)*, 463-464.
7. Kwan-Min Lee and Clifford Nass. 2005. Social-psychological origins of feelings of presence: Creating social presence with machine-generated voices. *Media Psychol* 7, 1: 31-45.
8. Andrea Lopez, Alissa Detz, Neda Ratanawongsa, and Urmimala Sarkar. 2012. What patients say about their doctors online: a qualitative content analysis. *J Gen Internal Med* 27, 6: 685-692.
9. Ewa Luger and Abigail Sellen. 2016. "Like having a really bad PA": the gulf between user expectation and experience of conversational agents. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '16)*, 5286-5297.
10. Susan M. Mudambi and David Schuff. 2010. What makes a helpful review? A study of customer reviews on Amazon.com. *MIS Quart* 34 1: 185-200.
11. Clifford Nass and Youngme Moon. 2000. Machines and mindlessness: Social responses to computers. *J Soc Iss* 56 1: 81-103.
12. Clifford Nass, Youngme Moon, and Paul Carney. 1999. Are people polite to computers? Responses to computer-based interviewing systems. *J Appl Soc Psychol* 29, 5: 1093-1109.
13. Clifford Nass, Youngme Moon, B. J. Fogg, Byron Reeves, and Chris Dryer. 1995. Can computer personalities be human personalities? In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '95)*, 228-229.
14. Clifford Nass, Jonathan Steuer, Ellen Tauber, and Heidi Reeder. 1993. Anthropomorphism, agency, and ethopoeia: Computers as social actors. In *INTERACT'93 and CHI'93 conference companion on Human factors in computing systems*, 111-112.
15. Sabine Payr. 2013. Virtual butlers and real people: Styles and practices in long-term use of a companion. In R. Trappl (Ed), *Your Virtual Butler*. Springer-Verlag, Berlin, pp. 134-178.
16. Jun Xiao, John Stasko, and Richard Catrambone. 2004. An empirical study of the effect of agent competence on user performance and perception. In *Proceedings of the 3rd International Joint Conference on Autonomous Agents and Multiagent Systems*, 178-185.