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# THE PERCEPTION OF GENDER IN VOICE ASSISTANTS

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## ABSTRACT

Voice assistants have been developed over the years to perform tasks that naturally require human comprehension to deliver and receive information. Today's direction of information technology is heavily dependent on the user's experience as it determines a technology product's use amongst consumers. In most smart devices and other similar technology products, voice assistants are represented with a vocally identifiable gender affecting the user's experience. This study analyzes how a user's perception of this vocally identifiable gender impacts their level of information acceptance and identifies the challenges and lessons learned when using voice assistants.

## Keywords

Voice Assistants, Gender, Information acceptance, User preference

## INTRODUCTION

This research focuses on the interactions found between a user and their personal voice assistant. A voice assistant is a digital assistant capable of generating information for a user through voice queries (Phan, 2017). Mobile devices (i.e. Smartphones), tablets, computers, and even watches all carry the ability to display intelligence through a voice assistant (Obinali, 2018). The term "smart" is typically attached to devices that have this ability to provide information and tasks in a useful way. Several voice assistants have been able to portray almost human-like personalities thanks to advanced natural language processing, speech synthesis, and, for some, a vocally identifiable gender (Reeves, 2016). Popular voice assistants Apple's Siri or Amazon's Alexa have become a household name as millions of users interact with them through a personal or housebound device. Several studies have been conducted addressing the use of voice assistants and artificial intelligence (AI) as well as the origin of vocally identifiable gendered voice assistant or the expectations a user may have in current and future. The study questions whether a user's perception of vocally identifiable gender impacts their level of information acceptance with a voice assistant. Some have been determined that usage is based on the consumer's desire; however, the question of where that desire and its influence stems from needs to be further explored.

## Societal Norms & Barriers

According to John R. Anderson (1991), the human mind is naturally inclined to work in categories for identification or survival purposes. John R. Anderson states that "categorization is justified by the observation that objects tend to cluster in terms of their attributes, be these physical features, linguistic labels, functions, or whatever." (1991, p. 411) Gender, one of the most common categories, is considered a social construct created and regularly maintained by society and is often used to identify one's state as a male or female (Ivy, 2012). An individual member of society is typically given the label masculine or feminine based on their gender and/or traits they harbor that align with those alike. According to Ivy (2012), those identified as masculine are independent, aggressive, and ambitious whereas the feminine counterpart is seen as warm, relationship-oriented, and caring. While categorizing can help eliminate complex interactions, they can easily lead to prejudice and stereotyping without one being aware of it (Anderson, 1991).

## Feminine & Masculine Communication Styles

When communicating, those considered feminine are predicted to be open and prone to acceptance (Obinali, 2018). It is expected of them to express how they feel, what they value, and disclose information they find worthy of through both verbal and non-verbal cues (Montgomery & Norton, 1981). Masculine individuals, in contrast, are anticipated to have a communication style that is more inward, blunt, and assured (Montgomery & Norton, 1981). Both are typically used to support labeling and the genders that exist in society as a form of self-fulfilling management. Ivy explains that stereotyping takes the least amount of effort when trying to get to know someone despite the extremely high possibility of misjudgment (2012). According to Ivy (2012):

In American culture, the stereotypical woman is soft-spoken (when she speaks at all), emotional, self-effacing by reflecting uncertainty and humbleness, and compliant through submissiveness. Femininity results in warm and continued relationships, a sense of maternity, interest in caring for children, and the capacity to work productively and continuously in female occupations (p. 45).

In contrast, the stereotypical man is confident in their actions, dominant, and less emotionally expressive (Ivy, 2012). To young boys, manhood is something that has to be earned, not given (Obinali, 2018). Supporting evidence can be seen in day-to-day phrases such as “Be a Man!” or “You’re just a boy; Leave this to the real men.” Social consequences are given to individuals that lack or fail to obtain mannerisms that make them masculine or feminine (Ivy, 2012). These are often judged as abnormalities or even weakness in many groups (Obinali, 2018).

**Voice Assistants**

When assessing voice assistants, it is important to start with the basic levels of development. Voice assistants were devised to aid people in completing basic tasks such as making phone calls or adding events to one’s calendar similar to those in a secretarial role (Obinali, 2018). A benefit to having a voice assistant is the ability to simply ask for what is needed (Phan, 2017). A good secretary is considered a strong communicator, friendly, helpful, and, most importantly, obedient as it is their job to follow instructions given to them by their boss (Obinali, 2018). Based on Ivy’s (2012) indication of society’s expectations, the stereotypical woman has been the ideal candidate for decades. “For virtual assistants, they operate on an even lower subservient range where they work in the benefit of the user alone” (Obinali, 2018). In the early stages of Apple’s Siri, the feminine voice was the only option before becoming a default. For many, this would not be unexpected as “the female gendered voice emerges as the ‘natural’ choice for this role [as Siri]” (Phan, 2017, p. 30).

In a study on political campaign advertisements, persuasive power in decision making originated from the arbitrary credibility a voice could have in conversation (Starch et. al., 2015). This meant that a consumer was willing to accept what they were being told if the voice behind it was pleasant enough to convince them. This translates into user experience which is the overall experience a user has when using a product or web-service (Carr & Hayes, 205). It has become a very prominent field as it is considered the main factor in a consumer’s satisfaction and return (Carr & Hayes, 205).

The automation behind a voice assistant is another example of technology designed with the user’s experience in mind (Reeves, 2016). When engaged in dialogue, voice assistants operate using imbedded technology such as Natural Language Programming (NLP) which allows them to analyze and decipher the conversation and essentially “learn” from the user’s verbal habits. It can then process “the data alongside millions of other data points gathered from other users... and assign users an algorithmic identity that can then be addressed by meticulously customized assistance” (Reeves, 2016, p. 159). Though impressive, the exchanges between a user and voice assistant can build bias leading to the idea of higher usage for a specific vocally identifiable gendered assistant is the result of a higher level of persuasion present. Hence, the following hypotheses:

*H1: When given an option, people are more likely to accept information from voice assistants with greater perceived vocal pleasantness.*

**METHODOLOGY**

**Participants and Collecting Data**

The researcher recruited participants from students enrolled at a south eastern U.S. university. Students were recruited via the university’s e-learning management platform using the following general news announcement:

We are conducting an academic survey about people’s perceptions of voice assistants found on modern computing devices (e.g. Apple’s Siri, Amazon’s Alexa). To qualify, you must be over the age of 18, located in the U.S., and have experience with using voice assistants. If you are interested to participate, please visit the link below. Participation in this survey is voluntary, and if you choose to participate, you will first be asked to provide informed consent.

Those who disagreed with the informed consent form or failed to meet other qualifications were immediately dismissed from the survey as participants were only accepted based on qualifications imbedded into the Qualtrics survey.

There were 150 (N = 150) participants with 41 (27.3%) being female and the remaining 109 (72.2%) being male. Participants were mostly aged 18-24 (91.3%) with the remaining being 25 and up (8.7%). Their academic background ranged from some college to doctoral and others as seen in Table 1 below.

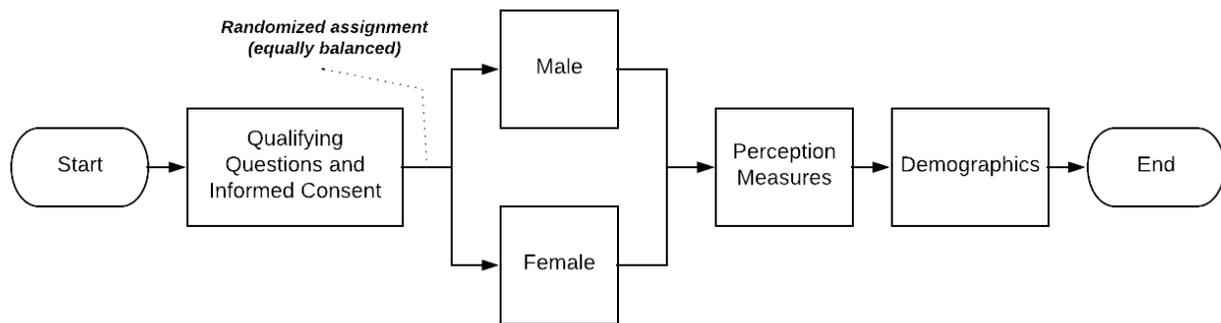
	Descriptive	Value (Percentage)
Age	18-24	91.3
	25 +	8.7

Gender	Female	37.3
	Male	72.2
Education	Some College	60.6
	2 or 4 yr. Degree	10
	Graduate / Master's Degree	28
	Doctoral, Professional, or Other	1.4
<b>Table 1: Demographic Sample Statistics</b>		

**Survey Instrument**

Qualtrics was used to collect data and administer the experiment. It is a web-based surveying tool used to conduct research, evaluations, and other data collection activities. Qualtrics' was considered the best option due to its built-in software. The leading feature being the constraint logic programming where researchers may set conditions for an action such as concluding surveys early for participants who have indicated they are not of age.

All surveys were presented in the same manner using the conditions placed in the survey as well as the nature in which it is distributed (via online weblink). Potential surveyors are notified through a Folio news announcement of the assessment linking them to the survey site where they provide informed consent to participate. No registration was needed to gain URL access. Accepted participants were to follow the survey instructions answering questions with honesty.



**Figure 1. Survey Flow**

As seen in Figure 1 above, the survey flows through four main stages: Qualifying Questions and Informed Consent, Randomized Assignment (experimental treatment), Perception Measures, and Demographics. The initial stage determined whether the user is a qualified surveyor. To prime the subject for the Perception Measures, the survey assigned the participant to an audio clip spoken by Apple's voice assistant, Siri, in which the voice assistant's vocal gender (Male or Female) is equally randomized. The following exchange was created and recorded using Siri to incorporate realistic inquiries:

**What is the weather today?** Looks like nice weather coming up today – up to 66°F

**What was the score between the Dodgers and the Red Sox in the World Series this year?** The Red Sox won the World Series 4 to 1 over the Dodgers. They won the last game 5 to 1.

**Please tell me a joke.** How do you put a baby astronaut to sleep? You rocket.

The Perception Measures included a series of questions regarding the audio clip they heard as it relates to their perceived pleasantness, the gender of the VA heard, the participants own gender, and their personal preference in voice assistants. Perceived pleasantness is defined as the level in which the survey's VA was identified as enjoyable or pleasant. Gender preference is the perceived gender that the participant would prefer to hear on their voice assistant. A manipulation check was also placed in the survey to verify that the participant correctly perceived the intended gender of the VA.

## ANALYSIS AND RESULTS

### Hypothesis Testing

We conducted a regression analysis with information acceptance as the dependent variable and perceived pleasantness as the independent variable. The gender of the person and the gender of the voice assistant they are primed with were used as a control. Upon examination we found that perceived pleasantness was significant ( $p < .05$ ), supporting the main hypotheses of pleasantness affecting information acceptance of voice assistance.

	Mean	Std. Dev.	B	Std. Error	Sig.
Perceived Pleasantness	20.64	3.86	0.319	0.050	0.000
Gender (of the person) *	1.73	0.45	-0.226	0.437	0.606
Gender (of the VA) *	1.47	0.50	0.120	0.385	0.757
Note: Dependent Variable: Information Acceptance (Mean = 16.73, Std. Dev = 2.61, $R^2 = 0.23$ ) * control variables					
<b>Table 2. Regression Analysis</b>					

### Post Hoc: Female to Male Analyses

With these results, we also wanted to explore how the variables may vary depended upon the treatment condition (male vs. female voice) and the person's individual gender. Two additional post hoc analyses were conducted using a one-way analysis of variance (ANOVA) which discovers any statistically significant differences between the means of two groups.

The first analysis examined the recorded voice assistant's pleasantness and the participant's gender preference based on their assigned treatment group (male or female voice assistant). The results showed no significant differences in pleasantness (Pleasantness:  $p = 0.133$ ) or gender preference (Gender Pref:  $p = 0.086$ ) in relation to the treatment group's perceived gender. Illustrated in Table 3 below, the compared mean of female and male participants may suggest that women perceive the voice assistant as more pleasant than men, but additional work would be needed to confirm.

Variable	Treatment	N	Mean	Std. Deviation	Significance
Perceived Pleasantness	Female	79	21.09	3.82	0.133
	Male	71	20.14	3.86	
VA Gender Preference	Female	79	10.96	2.61	0.086
	Male	71	10.25	2.39	
<b>Table 3: Comparative Analysis Based on Treatment Group</b>					

The second analysis compared the voice assistant's pleasantness and the participant's personal gender preference as well, but the comparisons was conducted based on the gender of the participant. The result of this ANOVA analysis showed a significant difference as seen in Table 4.

Variable	Participant's Gender	N	Mean	Std. Deviation	Significance
Perceived Pleasantness	Female	41	21.93	4.30	0.012
	Male	109	20.16	3.58	
VA Gender Preference	Female	41	9.80	2.64	0.014
	Male	109	10.94	2.42	

**Table 4: Comparative Analysis Based on Participant's Gender**

## DISCUSSION

The findings from the regression analysis provide a glimpse of potential evidence that people are more likely to accept information given by a voice assistant if they perceive the voice as pleasant. They are suggested to be significantly related because they have a linear relationship thus supporting the original hypothesis. While priming did not have an effect on pleasantness nor the individual's preferences, a person's gender did have an effect on both factors.

No significant differences were detected in the first ANOVA analysis; however, significant results could be produced if an evaluation of a participant's behavior while using a voice assistant in real time. In doing so, we would be able to better assess the relationships.

Currently, there is no reasonable cause to the significance found in the second ANOVA analysis; however, it may suggest that those who identify as a woman are more attuned to a voice assistant's tone. This would work well with the previous claims regarding society's joint approval of individuals harboring a pleasing if not charming attitude in roles that are supportive., this analysis still requires more testing to receive stronger backing.

## LIMITATIONS AND FUTURE WORK

The results of the study support H1; however, because the recruitment primarily targeted students within the IT department and specifically contacted professors in addition to only using Apple's Siri, results may not translate to users with a different academic background or device. Given the distribution of the survey in a classroom setting, some limitations could include distractions such as noise pollution and inconsistent technology (i.e. Headphone Quality). To improve on this work, future studies can include a larger subject pool beyond that of a sampling of university students.

Future studies can include other variations of voice assistants (i.e. Amazon's Alexa or Google Home as well as users whose native tongue is not English as these users are more likely to carry an accent or use a voice assistant that speaks in a different language. These differences may or may not reveal personal expectations or even societal expectations that are regionally based and not seen in the U.S. Another question we may be able to explore is finding a voice assistant whose intended gender cannot be guessed by users – a neutral voice that users find equally pleasant.

## CONCLUSION

In summary, this study provides insight on the amount of influence a user's perception of vocally identifiable gender can have on their level of acceptance when given information from a voice assistant. It has shown potential evidence that people are more likely to be more receptive to a voice that is pleasant. It also suggests there may be persuasive power in women and femininity vocally thereby having influence on users of both genders, but further exploration needs to be made. As the use of voice assistants and similar technology increases, more conversations and research on how users have a major preference for and enjoy being assisted by a female-voiced voice assistant needs to be conducted as this could translates into societal expectations for women.

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