The Effects of Chatbot Gender on User Trust and Perception towards Shopping Chatbots

Hsiao-Chen You, National Taichung University of Science and Technology, Taiwan
Yi-Chieh Chen, National Taichung University of Science and Technology, Taiwan

The Asian Conference on the Social Sciences 2019
Official Conference Proceedings

Abstract
This study investigates the influence of chatbot's gender on users' trust and perception toward shopping chatbots in social media marketing, to better understand whether people perceive chatbots differently just because of their gender cues on screen. A between-groups experiment was conducted, 120 participants were recruited to interact with one of the four chatbots with distinct gender cues: (1) a chatbot with female profile image and female name; (2) a chatbot with female profile image and unisex name; (3) a chatbot with male profile image and male name; (4) a chatbot with male profile image and unisex name. Afterwards, participants were requested to fill in a Likert scale questionnaire regarding their trust and perception towards chatbots based on the experience. Findings showed that chatbot gender did not have a statistically significant influence on users' trust and perception towards chatbots in an online shopping context. However, subjects tended to rate chatbots of the opposite gender as more trustworthy than chatbots of same gender.

Keywords: Conversational User Interface, Chatbot, Gender Cues, Trust, Perception

Introduction

As artificial intelligence technologies are advancing at an ever increasing rate, various types of virtual assistants and customer service bots have emerged in the market and focused on assisting people through social interaction (Ali, 2018). Statistics on consumer technology usage predicts that software agents for personal assistance, entertainment, or other social purposes will become a common scene in our future life (The European Commission, 2018). Starting in 2014, many social networking systems have introduced support for chatbots, which are enhance conversational agents, to help users while chatting with them, right inside the social media apps and sites (Klopfenstein, 2017). Many companies are already using them to better communicate with their target audience, provide customer service, recommend products, and drive sales. Chatbots are increasingly offered as an alternative source of customer service, and are predicted to tackle 85% of customer service interactions by 2020 (Levy, 2016).

Therefore, it is important that users trust chatbots to provide the required support, especially in e-commerce. However, there is currently a lack in knowledge regarding the factors that affect users' trust in chatbots. Hay (2017) argues that people consciously (or subconsciously) assign character or personality to their interactions with inanimate objects from the ATM to computers, because it's the way people build connections which leads to trust, and suggests that the most effective way to build trust between users and chatbots is to show a consistent and upright personality throughout the interaction. In order to create trust in chatbots and coherent interaction, chatbot designers nowadays often start by assigning a human-ish character to a chatbot, such as gender (Ramos, 2018). However, Fanguy (2018) argues nowadays AI developer routinely give female names to the things people issue commands to without user feedback or input from socially-minded design experts. It could reinforce people's biases about gender and the role of women in society role.

How can we better harness technology innovation and knowledge to advance gender equality—and vice versa? Gendered Innovations (GI) has become a new topic in the field of science, health& medicine, engineering, etc. The concept of Gendered Innovations (GI) is to integrate gender analysis into all phases of research to stimulate knowledge and new ideas (Schiebinger, 2014). Therefore, to better understand whether people perceive chatbots differently just because of their gender or gender cues, this study applies gender analysis to investigate the influence of chatbot's gender on users' trust and perception toward shopping chatbots in Ecommerce.

Related Studies

1. Conversational User Interface

A conversational user interface (CUI) is an interface that allows users to interact with computers or bots using language, whether it be text or speech. To do so, conversational interfaces use Natural Language Processing (NLP) to allow computers to understand, analyze and create meaning from human language. While there are a variety of CUIs, there are two main categories: voice assistants and chatbots. Voice assistants such as Apple Siri and Amazon Echo allow users to complete tasks simply by speaking commands. Chatbots are web or mobile based interfaces that allow users

to ask questions and retrieve information by clicking buttons, auditory or textual input (Pan, 2017). Chatbots can be classified by their usage into categories such as conversational commerce (e-commerce via chat), customer support, education, entertainment, finance, HR, news, shopping, social, utilities, etc. (Baron, 2017).

2. Gender Cues

For decades, researchers and developers have dedicated effort to make intelligent agents more human-like, and the easiest way might be the use of the human figures. Go & Sundar (2019) suggest that simple interface-level manipulation of chat bots and human visual (anthropomorphic) cues can trigger "anthropomorphism" switches that guide users to think of chat robots as humans and take social action. Another easy way to enhance the humanization of chat bots is to use human names or labels. The same goes for gender manipulation, visual appearance, names, or gender labels are often used as gender cues for intelligent agents (Hegel, Eyssel & Wrede, 2010; Trovato,Lucho & Paredes,2018). Other human features, such as voice, facial expressions and gestures, have been commonly employed in HRI to genderize robots as well (Siegel, Breazeal & Norton, 2009; Park, Kim, & Del Pobil, 2011). However, as Lee (2008) pointed out, manipulation of computer gender might have unexpected side effects. For instance, it could trigger social stereotypes associated with gender. Furthermore, the artificial gender of computer system might serve as a cue to a shared group identity, evoking social identification effects.

3. Gender Effect in HRI

The gender effect has been studied extensively in the field of interpersonal communication and social psychology (Rosenkrantz et al., 1968; Nass, Moon, & Green, 1997). Several studies indicated that gender stereotypes could carry over to computers or virtual agents when computer systems expressed gender through gender cues (Lee, 2003; Martin & Macrae, 2007). As robots and AI gradually become part of our everyday life, an area of studies within Human-Robot Interaction (HRI) has arisen to explore the overlap between robotics and gender studies, and to investigate whether gender bias exists in HRI. For example, Eyssel & Hegel (2012) found participants tented to apply gender stereotypes to robots. For instance, the short-haired robots were perceived as male with agentic traits, while the long-haired robots are perceived as female with communal traits more communal. Moreover, stereotypically male tasks were perceived more suitable for the male robot than the female robot, and vice versa. In a study of the persuasive robots, Siegel, Breazeal & Norton (2009) utilized behavioral measures and self-reported questionnaire in an experiment design to investigate the gender effects on the persuasiveness of robots. The result showed that men were more likely to donate money to a female robot (cross-gender effect), but women were not affected by the gender of robots. Thellman et al. (2018) utilized a self-reported questionnaire as attitude measures to replicate Siegel's persuasiveness study. In contrast to the finding of the earlier study, the results showed the gender of robots did not influence the perceived persuasiveness, while male and female participants view robots differently, female participants rated the HRI as more persuasive than men overall. Zanbaka et al.(2006) examined the roles of gender and visual realism in the persuasiveness of speakers. Results indicated that the virtual speakers were as effective as real people; ratings of the perceptions of the speaker were more favorable for virtual speakers than for human speakers. Speakers of the

opposite gender were more persuasive than speaker of same gender (cross-gender preference). Besides impact of robot's or human gender on HRI, Crowell et al.(2009) further studied the effect of physical body of artificial agent on user perception. The results showed female-voice agent (without physical body) were rated more trustworthy than male-voice agent, while male-voice robot (with physical body) were rated more trustworthy than female-voices robot.

Method

This study aims to provide an empirically grounded answer to the question: does the gender of chatbots affect participants' trust in them in an online shopping context. Based on the above-mentioned literatures, the three research questions this study wants to explore are as follows:

1. Can participant perceive a chatbot's gender through its gender cues?
2. Does the gender of chatbots affect participants' trust in shopping chatbots?
3. Does the participant gender affect the participants' judgment on the trustworthiness of shopping chatbots?

While it would have been possible to conduct one study to explore the above mentioned three research questions at once, such a full factorial design seemed unwarranted until more is known about the effects of visual cues on users' judgment on chatbot gender, then we can further examine the impact of chatbot gender on user perception and trust. Thus, two separate studies were conducted. Study I is to investigate whether hair length, eyebrow thickness, and color of coat can be used as gender cues for chatbots. Study II is to further investigate whether the gender of chatbots affects the trust and perception of the participants.

1. Study I Effects of Visual Cues on Gender Differences

In this study, our focus is on the visual gender cues in chatbot's profile pictures. By the use of three gender cues: hair length (long, short), eyebrow thickness (thick, thin), and color of coat (blue, pink), 8 chatbot profile pictures were created (Table 1). 134 Participants were recruited from social platforms. Each of them are asked to view the 8 chatbot profile pictures on line, and determined the gender of each chatbot on a 5-point Likert scale online questionnaire (from 1 to 5: very masculine, masculine, undecided, feminine, very feminine).

Visual Cues	Short Hair		Long Hair	
	Blue Coat	Pink Coat	Blue Coat	Pink Coat
Thick Eyebrow				
Thin Eyebrow				

Table 1: The 8 chatbot profile pictures as experiment stimuli in study I

One-way analysis of variance (ANOVA) is used to investigate the effect of each visual cue gender on user judgement of chatbot gender. The results of the ANOVA showed the effects of three visual cues are statistically significant. Then Duncan's Multiple Range test (DMRT) is applied. The results indicated: (1) the three visual cues (hair length, eyebrow thickness, and color of coat) did significantly affect user perception of chatbot gender, (2) the combination of short hair, thick eyebrows and blue coat was perceived most masculine; while the combination of long hair, fine eyebrows and pink coat was perceived most feminine. Based on the results, the most male-like and the most female-like avatar were selected for the next phase of the study.

2. Study II Effects of Gender on User Trust and Perception towards Chatbots

The independent variable is chatbot gender. A simple version of e-commerce chatbot made by Chatisfy, a chatbot-creation platform, with different gender cues is used in this experiment.

There are two type gender cues: visual cue (masculine/ feminine look) and gender name (male name / unisex name/ female name). After abandoning two internal conflict conditions, there were four condition: (A) masculine look chatbot with male name, (B) masculine look chatbot with unisex name, (C) feminine look chatbot with unisex name, and (D) feminine look chatbot with female name (Table 2). Conditions A and B are intended as the male chatbots, while conditions C and D are intended as the female chatbots. The dependent variable is participant's trust in the shopping chatbot. A questionnaire was developed based on the work done by Gefen, (2002) to obtain participants' personal information regarding age, gender, then followed by the trust measures: ability, integrity (credibility, justice), kindness (friendliness, good intention, thoughtfulness), and engagement. There were 28 question items, each answered on a 5-point Likert scale (from 1 to 5: very unlikely, unlikely, undecided, , likely, very likely).

Independent Variable	Masculine look	Feminine look
Male Name (Shèng-bó)	Condition A	
Unisex Name (Yǔ-fān)	Condition B	Condition C
Female Name (Mǐn-huì)		Condition D

Table 2: The combination of gender cues in the four experiment conditions

In addition to the limited dialogue function provided by the chatbot platform, the Wizard of Oz technology was used to allow the experimenter to intervene in the background when needed. In other words, the chatbots were partially controlled by experimenters while participants perceived them to be autonomous. An elaborate script with the possible scenarios in chat commerce was carefully planned. Based on the script, a set of chatbot responses were prepared, so the unseen experimenter in the Wizard of Oz experiment could easily operate chatbots according to the standard operating procedure.

The experiment was a between-group design. 120 participants (60 female and 60 male, age range 20-60.) were equally distributed across the four experiment conditions. Each participant was given an individual appointment for the experiment. Upon arrival, the participant was initially welcomed and explained the purpose of the study. Before the experiment, the participant was asked to identify the gender of

shopping chatbot on a 5-point Likert scale questionnaire. Then, the participant was asked to use a shopping chatbot via FB Messenger, and experience online clothes browsing with a chatbot. Finally, participant was asked to rate his/her subjective feeling about the shopping chatbot according to the experience.

Results

We used factor analysis to confirm the factorial structure and reliability of the questionnaire. After removing some of the inappropriate question items, the results (Table 3) indicates the measure are acceptable validity and reliability. Then we applied t-test to investigate the effect of chatbot's gender on trust measurements from all participants. The results of the t-test are presented in Tables 4. In contrast to previous studied on gender bias towards service robots or virtual assistants, the gender of chatbots did not influence the rated trust from all participants.

Variable	Factor	Cronbach's alpha	No. of Items
Ability	----	0.957*	9
Integrity	Credibility	0.855*	4
	Justice	0.789*	3
Kindness	Friendliness	0.783*	3
Engagement	------	0.878*	5

*Indicates internal consistency of the set of test items is acceptable

Table 3. Validity and reliability of the questionnaire

Variable	Factor	Item	Male Chatbot		Female Chatbot		T-value	Sig
			Mean	SD	Mean	SD		
Ability		Ab01	3.65	.755	3.55	.769	-0.719	.474
		Ab02	3.87	.791	3.55	.946	-1.988	.049*
		Ab04	3.73	.800	3.72	.922	-0.106	.916
		Ab05	3.37	.823	3.37	.938	0.000	1.000
		Ab06	3.43	.745	3.52	.854	0.570	.570
		Ab07	3.87	.812	3.80	.898	-0.426	.671
		Ab08	3.67	.816	3.72	.739	0.352	.726
		Ab09	3.72	.761	3.62	.940	-0.640	.523
		Ab10	3.53	.929	3.68	.873	0.911	.364
Integrity	Credibility	In06	2.93	.936	2.80	1.086	-0.720	.473
		In07	3.07	.918	2.92	.889	-0.909	.365
		In05	3.95	.811	3.97	.736	0.118	.906
		In03	3.22	.825	3.03	882	0.242	.242
	Justice	In02	3.57	.789	3.35	.777	-1.515	.132
		In01	3.53	.747	3.45	.746	-0.611	.542
		In04	3.73	.918	3.75	.914	0.100	.921
Kindness		Be05	4.10	.730	4.37	.637	2.133	.035*
		Be09	3.70	.788	3.73	.710	0.244	.808
		Be06	4.10	.775	3.97	.843	-0.902	.369
Engagement		If01	3.57	.722	3.53	.833	-.234	.815
		If07	3.67	.774	3.60	.785	-.468	.640
		If04	3.47	.833	3.47	.650	.000	1.000
		If05	3.80	.798	3.63	.802	-1.141	.256
		If03	3.82	.748	3.77	.810	-.351	.726

*Indicates significant value at the 0.05 level

Table 4. Effect of chatbot's gender on participant's trust in chatabots

We also applied t-test to investigate the effect of participant's' gender on trust measurements towards all chatbots. The results of the t-test are presented in Tables 5. As the data shown in Table 5, male participants rated two subscales (credibility and justice) under integrity dimension of trust significantly higher than female participants did, but no difference in ratings of the ability, kindness and engagement dimensions. Thus, the gender of participants did influence their trust in chatbots in part. Then we took a close look at the interaction effect between chatbot gender and participant gender on dependent variables. First, a t-test was used to inspect the effect of participant's' gender on trust towards the male chatbots alone. The results showed no significant differences between male and female participants. Secondly, we used t-test to inspect the effect of participant's' gender on trust towards the female chatbots alone. As the data shown in Table 6, male participants rated the subscale credibility under integrity dimension significantly higher than female participants did.

Variable	Factor	Item	Male Participant		Female Participant		T-value	Sig
			Mean	SD	Mean	SD		
Ability		Ab01	3.68	.748	3.52	.770	1.203	.231
		Ab02	3.82	.833	3.60	.924	1.349	.217
		Ab04	3.80	.819	3.65	.899	.955	.341
		Ab05	3.47	.929	3.27	.821	1.250	.200
		Ab06	3.55	.811	3.40	.785	1.029	.150
		Ab07	3.92	.907	3.75	.795	1.070	.287
		Ab08	3.75	.836	3.63	.712	.823	.412
		Ab09	3.73	.880	3.60	.827	.855	.394
		Ab10	3.77	3927	3.45	.852	1.948	.054
Integrity	Credibility	In06	3.10	.969	2.63	1.008	2.585	.011*
		In07	3.20	.860	2.78	.904	2.588	.011*
		In05	4.08	.636	3.83	.827	1.792	.076
		In03	3.28	.739	2.97	.938	2.054	.042*
	Justice	In02	3.60	.785	3.32	.770	1.995	.048*
		In01	3.60	.694	3.38	.783	1.604	.111
		In04	3.78	.825	3.70	.997	.499	.619
Kindness		Be05	4.22	.715	4.25	.680	-.262	.794
		Be09	3.65	.709	3.78	.783	-.978	.330
		Be06	3.97	.823	4.10	.796	-.902	.369
Engagement		If01	3.68	.770	3.42	.766	1.902	.060
		If07	3.77	.851	3.50	.676	1.900	.060
		If04	3.48	.676	3.45	.811	.244	.807
		If05	3.82	.770	3.62	.825	1.373	.173
		If03	3.85	.820	3.73	.733	.822	.413

*Indicates significant value at the 0.05 level

Table 5. Effect of participant's gender on participant's trust in chatabots

Variable	Factor	Item	Male Participant		Female Participant		T-value	Sig
			Mean	SD	Mean	SD		
Ability		Ab01	3.57	.858	3.53	.681	.167	.868
		Ab02	3.73	.980	3.37	.890	1.517	.135
		Ab04	3.87	.819	3.57	1.006	1.266	.210
		Ab05	3.53	1.008	3.20	.847	1.387	.171
		Ab06	3.67	.884	3.37	.809	1.371	.176
		Ab07	3.93	.980	3.67	.802	1.153	.254
		Ab08	3.77	.858	3.67	.606	.521	.604
		Ab09	3.77	1.040	3.47	.819	1.241	.220
		Ab10	3.90	1.029	3.47	.629	1.968	.054
Integrity	Credibility	In06	3.10	1.094	2.50	1.009	2.209	.031*
		In07	3.17	0.913	2.67	.802	2.253	.028*
		In05	4.13	.730	3.80	.714	1.787	.079
		In03	3.27	.828	2.80	.887	2.107	.039*
	Justice	In02	3.47	.900	3.23	.626	1.166	.248
		In01	3.57	.774	3.33	.711	1.216	.229
		In04	3.90	.803	3.60	1.003	1.279	.206
Kindness		Be05	4.40	.675	4.33	.606	.403	.689
		Be09	3.77	.626	3.70	.794	.361	.719
		Be06	3.90	.885	4.03	.809	-0.069	.545
Engagement		If01	3.73	.907	3.33	.711	1.901	.062
		If07	3.77	.858	3.43	.679	1.668	.101
		If04	3.50	.630	3.43	.679	.394	.695
		If05	3.80	.805	3.47	.776	1.633	.108
		If03	3.57	.858	3.53	.681	.167	.868

*Indicates significant value at the 0.05 level

Table 6. Effect of participant's gender on participant's trust in female chatabots

In addition, an ANOVA was conducted to compare the effect of participants' age on dependent variables. As the data shown in Table 7, the participants' age did influence their trust in chatbots significantly in most of items, even though the pattern was not clear.

Variable	Factor	Item	20's	30's	40's	50+	p-value
Ability		Ab01	3.67	3.96	3.10	3.34	.003*
		Ab02	3.84	3.92	3.40	3.38	.046*
Integrity	Credibility	In06	2.98	3.00	2.50	2.66	.293
		In07	3.12	3.25	2.50	2.69	.023*
		In05	4.19	3.96	4.00	3.48	.001*
		In03	3.32	3.04	2.50	3.03	.031*
	Justice	In02	3.58	3.54	3.10	3.28	.155
		In01	3.67	3.71	2.90	3.17	.000*
		In04	3.70	4.08	3.80	3.52	.152
Kindness		Be05	4.33	4.63	4.00	3.79	.000*
		Be09	3.70	4.00	3.20	3.69	.038*
		Be06	4.02	4.29	3.90	3.90	.314
Engagement		If01	3.65	3.83	3.20	3.24	.012*

*Indicates significant value at the 0.05 level

Table 7. ANOVA results of effect of participant's age on participant's trust in chatabots

Conclusion

In this study we present the results of an investigation on the impact of gender factor on user perception towards shopping chatbots, focusing specifically on the user's trust in chatbots. Our goal was explore whether the manipulation of chatbot's profile pictures would orientate the perception of chatbot gender and elicit different responses from participants. Based on the previous information, the conclusions of this study are:

1. The visual cues (hair length, eyebrow thickness, and color of coat) on chatbot profile image could significantly affect participants' perception of chatbot gender.
2. The influence of chatbot gender in participants' trust was not statistically significant in on-line shopping contexts.
3. The gender of participants did influence their trust towards chatbots in part. Male participants perceived shopping chatbots more credible and just than female participants did.
4. Male participants tended to give female chatbots statistically higher credibility ratings than female participants (cross-gender effect), while for male robots, male and female participants have little preference.
5. In comparison participants' gender, participants' age has more impact on participant's trust in chatabots.

The results suggests that impact form chatbot's gender alone is not as serious as we expected, when we focus on the perceived trustworthiness of chatbots. Rather, the user's own factors, including gender and age, play a very important role in the perception of trust and even gender bias, and deserve further study.

Acknowledgements

This work was partially supported by the Ministry of Science and Technology in Taiwan (Grant MOST 107-2221-E-025-004). We thank all the participants for their help in this study.

References

Ali, A. (2018) The Rise of Virtual Digital Assistant Usage – Statistics and Trends, Retrieved May 14, 2019 from https://mobiteam.de/en/the-rise-of-virtual-digital-assistant-usage-statistics-and-trends/

Baron, J. (2017) 2017 Messenger Bot Landscape, a Public Spreadsheet Gathering 1000+ Messenger Bots, Retrieved May 14, 2019 from https://cai.tools.sap/blog/2017-messenger-bot-landscape/

Crowelly, C. R., Villanoy, M., Scheutzz, M., & Schermerhornz, P. (2009, October). Gendered voice and robot entities: perceptions and reactions of male and female subjects. In *2009 IEEE/RSJ International Conference on Intelligent Robots and Systems* (pp. 3735-3741). IEEE.

Eyssel, F., & Hegel, F. (2012). (s) he's got the look: Gender stereotyping of robots 1. *Journal of Applied Social Psychology,* 42(9), 2213-2230.

Fanguy, W. (2018) Why do we keep gendering our AI assistants? Inside Design, Retrieved May 14, 2019 from https://www.invisionapp.com/inside-design/ai-assistant-gender

Gefen, D. (2002). Reflections on the dimensions of trust and trustworthiness among online consumers. *ACM SIGMIS Database: the DATABASE for Advances in Information Systems*, 33(3), 38-53.

Go, E., & Sundar, S. S. (2019). Humanizing Chatbots: The effects of visual, identity and conversational cues on humanness perceptions. *Computers in Human Behavior*, 97(2019), 304-316.

Hay,S.(2017) Even bots need to build character. Venture Beat. , Retrieved May 14, 2019 from https://venturebeat.com/2017/09/22/even-bots-need-to-build-character/

Hegel, F., Eyssel, F., & Wrede, B. (2010). The social robot 'flobi': key concepts of industrial design. In *19th International Symposium in Robot and Human Interactive Communication* (pp. 107-112). IEEE.

Klopfenstein, L. C., Delpriori, S., Malatini, S., & Bogliolo, A. (2017). The rise of bots: A survey of conversational interfaces, patterns, and paradigms. In *Proceedings of the 2017 Conference on Designing Interactive Systems* (pp. 555-565). ACM.

Lee, E. J. (2003). Effects of "gender" of the computer on informational social influence: the moderating role of task type. *International Journal of Human-Computer Studies*, 58(4), 347-362.

Lee, E. J. (2008). Flattery may get computers somewhere, sometimes: The moderating role of output modality, computer gender, and user gender. *International Journal of Human-Computer Studies*, 66(11), 789-800.

Levy, H. P. (2016) Gartner's Top 10 Strategic Predictions for 2017 and Beyond: Surviving the Storm Winds of Digital Disruption. Retrieved May 14, 2019 from https://www.gartner.com/smarterwithgartner/gartner-predicts-a-virtual-world-of-exponential-change/

Martin, D., & Macrae, C. N. (2007). A face with a cue: Exploring the inevitability of person categorization. *European Journal of Social Psychology*, 37(5), 806-816.

Nass, C., Moon, Y., & Green, N. (1997). Are machines gender neutral? Gender-stereotypic responses to computers with voices. *Journal of applied social psychology*, 27(10), 864-876.

Pan, J. (2017) Conversational Interfaces: The Future of Chatbots. Chatbot Magazine. Aug 25, 2017. Retrieved May 14, 2019 from https://chatbotsmagazine.com/conversational-interfaces-the-future-of-chatbots-18975a91fe5a

Park, E., Kim, K. J., & Del Pobil, A. P. (2011). The effects of robot's body gesture and gender in human-robot interaction. *Human-Computer Interaction*, 6, 91-96.

Ramos, R. (2018) 8 tips for designing a chatbot avatar, Venturebeat, Retrieved May 14, 2019 from https://venturebeat.com/2016/08/17/8-tips-for-designing-a-chatbot-avatar/

Rosenkrantz, P., Vogel, S., Bee, H., Broverman, I., & Broverman, D. M. (1968). Sex-role stereotypes and self-concepts in college students. *Journal of consulting and clinical psychology*, 32(3), 287.

Schiebinger, L. (2014). Gendered innovations: harnessing the creative power of sex and gender analysis to discover new ideas and develop new technologies. *Triple Helix*, 1(1), 9.

Siegel, M., Breazeal, C., & Norton, M. I. (2009). Persuasive robotics: The influence of robot gender on human behavior. In 2*009 IEEE/RSJ International Conference on Intelligent Robots and Systems* (pp. 2563-2568). IEEE.

Simon, M. (2018) It's Time to Talk About Robot Gender Stereotypes, WIRED, Retrieved May 14,2019 from https://www.wired.com/story/robot-gender-stereotypes/

The European Commission (2018) The Rise of Virtual Personal Assistants, Retrieved May 14, 2019 from https://ec.europa.eu/growth/tools-databases/dem/monitor/sites/default/files/Virtual%20personal%20assistants_v1.pdf

Thellman, S., Hagman, W., Jonsson, E., Nilsson, L., Samuelsson, E., Simonsson, C. & Silvervarg, A. (2018). He is not more persuasive than her: No gender biases toward robots giving speeches. In *Proceedings of the 18th International Conference on Intelligent Virtual Agents* (pp. 327-328). ACM.

Trovato, G., Lucho, C., & Paredes, R. (2018). She's Electric—The Influence of Body Proportions on Perceived Gender of Robots across Cultures. *Robotics*, 7(3), 50.

Zanbaka, C., Goolkasian, P., & Hodges, L. (2006, April). 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* (pp. 1153-1162). ACM.

Contact email: hcyou@gmail.com