Beyond Embodiment and Social Presence: Preferences for Virtual Assistant Gender and Clothing Style

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Abstract

While introducing a human-like embodied character can enhance social presence in computing technology, it can often be poorly received because user preferences for particular appearance-based attributes are not taken into account. To investigate some of these preferences, specifically gender and dress code, this paper extends the findings of a small exploratory, interview-based study, to data obtained from 390 participants aged between 16 and 82 who chose their preferred three-dimensional virtual assistant (VA) as part of an interaction with a self-service checkout (SSCO) simulation. These data were collected from visitors to an exhibition at a science center in the UK. Chi-Square tests revealed a preference for female VAs, but only by female participants. There was no preference for formality of dress. The paper discusses the appropriateness of the following psychological theories to explain these results: the stereotype content model, the behaviors from intergroup affect and stereotype (BIAS) map framework, and the shifting standards model of stereotypes.

One of the most significant discussions in Human-Computer Interaction (HCI) currently is what features of an embodied interface agent can help improve the interaction between a system and its user, e.g., Haake (2009), Vogeley and Bente (2010), and Payne, Johnson, & Szymkowiak (2011). An interface agent is a computer program implemented to help users complete on-screen tasks (Dehn & van Mulken, 2000). The human-like embodiment of these agents helps provide a sense of social presence in computing technology (Vogeley & Bente, 2010; Demeure, Niewiadomski, & Pelachaud, 2011), i.e., the perceptual awareness of another person (Abeele, Roe, & Panelare, 2007) or the feeling of human-like personal contact (Verhagen, van Nes, Feldberg, & van Dolen, 2011).

A sense of social presence can be induced via several social cues of an interface agent, not all of which rely on its appearance, including social dynamics (e.g. turn-taking, co-operation, and praise), psychology (e.g. humor, personality, and empathy), and language (e.g. interactive language, spoken language, and langauage recognition) (Fogg, 2003). In fact, it is argued that users will treat computers as social agents without any visual representation at all (Dehn & van Mulken, 2000; Reeves & Nass, 1996). However, evidence suggests that people tend to prefer an embodied interface agent with a dialogue box as opposed to text-only because it makes computing technology appear more personal and caring (Liu, Helfenstein, & Wahlstedt, 2008). Moreover, physical social cues not only enhance social presence (Fogg, 2003) but have been found to positively influence user performance and attitude – increasing efficiency, overall enjoyment, social collaboration, engagement, and satisfaction with a computer-based program as well as reducing learning time (Cowell & Stanney, 2005; McBreen & Jack, 2001).

Physical social cues include human-like features such as a face and body, as well as behaviors such as movement and nonverbal communication (Fogg, 2003). Another related cue for enhancing social presence is social role (Fogg, 2003), and this too can be implied by physical cues (e.g. uniforms or social grouping), even when it was not the intention of the designer. Common interface agent social roles are teacher and assistant. While these roles do not rely on appearance – it is reasonable for the role of an agent to be implied based solely on the type of gudiance it provides – they are often visually implied, e.g., via a lab coat or employee branding. Social roles can also be implied from visually apparent demographics such as age, gender, or ethnicity. Men and women, for example, are expected to behave in accordance with gender stereotypes which reflect the divergent social roles they typically perform, e.g., breadwinner and homemaker respectively

(Cross & Madson, 1997; Fiske, Cuddy, Glick, & Xu, 2002).

Via increased social presence, some of the visual social cues provided by an interface agent should encourage users to behave socially towards computing technology (Baylor & Kim, 2004; 2009), with consequences for human behavior and attitudes. For example, it has been found that a female interface agent in the role of teacher (or pedagogical agent) can have a positive impact on female student interest and self-efficacy even in a male-dominated domain (e.g. engineering, see Rosenberg-Kima, Baylor, Plant & Doerr, 2008). This paper looks at whether retail-based technologies too, and specifically self-service checkouts (SSCO), could benefit from an interface agent. While there is extensive work in the area of virtual characters and their look, there is a lack of research in the specific impact this has in a kiosk-based application, and in particular, a SSCO scenario. In this context, it is appropriate to term such agents as virtual assistants (VA), due to the role they are designed to play, i.e., to help and guide users through an interaction.

In a SSCO context, a VA has the potential, not only to increase user satisfaction by making the process more personal, but to speed-up checkout times by allowing users to rely on 'natural' interaction skills, and reduce error rates by providing clear directional cues (e.g. to the bagging area or where to weigh items, etc.). VAs could also increase motivation and engagement with the interface and allow users to perform tasks with less effort due to the ease with which most people follow and interpret social cues, especially when different modes of communication come together. Verbal messages, for example, are more effective when presented via the dual-modality of voice and visual presence (Rosenberg-Kima et al., 2008, see also Payne et al., 2011) and users are more effective at recognizing and responding to computer output when visual and audio cues merge (Gong, 2007).

1. Virtual Assistant Physical Attributes

Evidence suggests that appearance-based factors that influence human-human interaction also influence human-agent interaction (e.g. Reeves & Nass, 1996; Zanbaka, Ulinski, Goolkasian, & Hodges, 2007; Nowak & Rauh, 2008; Veletsianos, 2010). In recent years there has been increasing interest in the role of specific interface agent characteristics, from demographics and stable appearance-based features that tend to be out-with personal control such as attractiveness, gender, and ethnicity, to highly changeable physical attributes such as emotional expression, nonverbal behavior, and clothing. Research into some of these attributes suggests that a VA may be differentially beneficial or detrimental to human-computer interaction dependent on choices made about its visual appearance. The aim of this paper is to describe the preliminary results of a small interview-based study within an organization, and how this generalizes to the results of a much larger, activity-based study performed with the general public. Specifically, the focus is on the preference for VA gender and formality of dress within a SSCO context.

It is important that VA gender is not arbitrarily decided based on the idiosyncratic preferences of the designer because one gender may be deemed more appropriate than the other given the environment and roles that the VA is designed to play (MacDorman, Green, Ho, & Koch, 2009). It is also important that users are able to clearly identify which gender the VA has been assigned; people typically feel unease and embarrassment when another person cannot easily be categorized as male or female (West & Zimmerman, 1987) and this is reflected in a preference for highly gendered virtual characters (Nowak, Hamilton, & Hammond, 2008; Nowak & Rauh, 2008). This demonstrates the robustness of gender as a means of interpreting, understanding, and responding even to non-human entities. Other demographics, also, and commonly ethnicity (e.g. Cowell & Stanney, 2005; Pratt, Hauser, Ugray, & Patterson, 2007; Qiu & Benbasat, 2010; Rosenberg-Kima, Plant, Doerr, & Baylor, 2010), have been found to influence people's attitudes and behaviors. However, there are few detailed empirical studies that directly test the preference for male or female interface agents. We briefly describe some of these.

Cowell and Stanney (2005) carried out a pre-test to determine preferences for agent demographics, finding that most users selected a young-looking agent matching their own ethnicity and of the opposite sex. Thus, in the main experiment, the ethnicity was set to match that of the participant, the age was set at "young", and each participant freely chose VA gender before they begun. Thirty-five percent of the (all female) participants chose a female character, meaning the majority chose a character of the opposite sex, though this was not statistically significant. Baylor and Plant (2005) also found that female students tended to choose a male agent to learn from which reflected the male-dominated nature of the topic (engineering). Conversely, when learning was not the intent, these participants preferred to gender-match. However, in a similar learning-based context, Kim and Wei (2011) found that, even though the topic was male-dominated (math), there were gender-matching effects for

both male and female participants. Qiu and Benbasat (2010), on the other hand, found no gender-match effect, but rather, a general preference for female agents irrespective of user gender. In fact, they found that ethnicity was more influential than gender, especially for female users in terms of social presence and perceived enjoyment.

It is possible that gender preferences are mediated by the appropriateness of dress code in combination with the context, potentially explaining the varying gender-preference findings even in similar (male-dominated) contexts. In human-human interaction, the appropriateness of employee dress depends on the type and place of work (Shao, Baker, & Wagner, 2004). For virtual characters also, appropriate dress may be dictated by context. McArthur and Baljko (2009) for example, suggest that professionally dressed avatars in virtual worlds such as Second Life where corporate culture is not the norm may be subject to social stigma. This is in line with McBreen, Anderson, & Jack (2001) who found that the perceived appropriateness of an interface agent's dress was dependent on the seriousness of the (retail) context. They presented participants with four agents: smartly dressed male and female agents and casually dressed male and female agents within one of three retail environments: cinema, travel, or bank. Casually dressed agents were deemed more suitable for the cinema environment and formally dressed agents were deemed more suitable for virtual banking.

1.1. Applying Psychological Theory: Stereotype Content Models

The original stereotype content model (SCM, Fiske et al., 2002; Cuddy, Fiske & Glick, 2007) outlines two key dimensions that underpin out-group stereotypes: competence and warmth. High status corresponds with perceived competence, eliciting respect, and niceness/low threat corresponds with perceived warmth, eliciting liking. Fiske et al. (2002) maintain that subordinate and non-competitive out-groups (e.g. women) are stereotyped as warm but lacking competence, whilst those high status and competitive out-groups (e.g. Asians) are stereotyped as competent but lacking warmth. From the original SCM, Cuddy et al. (2007) developed the behaviors from intergroup affect and stereotype (BIAS) map framework to explore whether particular discriminatory behaviors result from competence-warmth stereotypes. This model explains that stereotypes of high warmth and low competence tend to result in 'rewards' for women in terms of being helped and liked (active facilitation), but also

encourages benevolent sexism, e.g., portraying women as less competent and excluding them (passive harm) (Cuddy et al., 2007; 2008), thus justifying their lower status (Crosby, Stockdale, & Ropp, 2007). These paternalistic behaviors would predict a general preference for a female VA when she is designed to play a primarily assistance-based role but a male VA if the task is perceived to require 'male expertise'.

1.2. Applying Psychological Theory: Shifting Standards Model of Stereotypes

The shifting standards model of stereotypes asserts that evaluations of an individual's traits are made based on stereotypical expectations of the social group to which they belong (Masser, Grass, & Nesic, 2007). For example, a physically attractive female may be considered as competent as her less attractive male counterpart because attractiveness is more central to the female gender role (Eagly, Ashmore & Makhijani, 1991). The same reasoning might be applicable to dress code, e.g., a formally dressed female might be considered as competent as a casually dressed male because competence is more readily attributed to males. This would predict that, for a female VA to appear 'suitable' and qualified for the role given the context, she should wear more formal clothing to imply competence, whilst in the same context a male VA need not signify competence in this way.

1.3. Summary

This study investigates the extent to which SCMs and the shifting standards model of stereotypes can be applied to VA choices in a SSCO context based on its formality of dress and implied gender. Before empirically exploring preferences for VAs based on these physical attributes, an exploratory study was carried out. The aim was to determine the extent to which preferences for actual employee physical appearance features, i.e., gender and dress code, would match the preference for VA gender and dress code, helping to determine the nature of the variables for examination in the main experiment.

2. Exploratory Study

Semi-structured interviews were conducted as part of a preliminary study into opinions of VA gender and dress code. The interview was designed to gain insight into how people might perceive a VA in a self-service fastlane™ context based on these characteristics. Specifically, the aim was to investigate opinions of supermarket employee

appearance and how this might apply to the preferred appearance of a VA in SSCO.

3. Method

3.1. Participants

Twenty-one employees from different departments across NCR in the UK were recruited as participants to take part in the study, nineteen of whom shopped for two or more people, and none were involved in projects in retail checkout technology. The age range was between 20 and 54 years old; eight participants were female.

3.2. Materials

A ranking tool was used as an exercise for participants. This involved presenting participants with four picture cards of male VAs and four of female VAs dressed in clothes ranging from formal to informal (a suit, shirt only, polo shirt, or t-shirt). Participants were given these in random order and asked to rank them in terms of formality. The order in which the male and female examples were given to participants to rank was counterbalanced such that approximately half were given the male examples first and half were given the female examples first. This ranking tool was implemented because it was considered a good way to encourage participants to become engaged with the interview early on and to ease them into the first main question.

The VA examples were created using *The Sims™ 3* (Electronic Arts Inc., 2011) computer game, taking screenshots of the same character in different clothing (see Figure 1). Due to constant animation within the game, the characters were not in identical positions for each shot. Before carrying out the experiment, the gaze direction of some of VAs was changed using Adobe Photoshop in an attempt to ensure they were seen to be looking in the same general direction. A suit jacket was also added to the most formal female example to make her comparable to the most formal male example whilst still fitting female norms of dress code.

The female examples were a feminized version of the male examples, i.e., created after the male prototype by
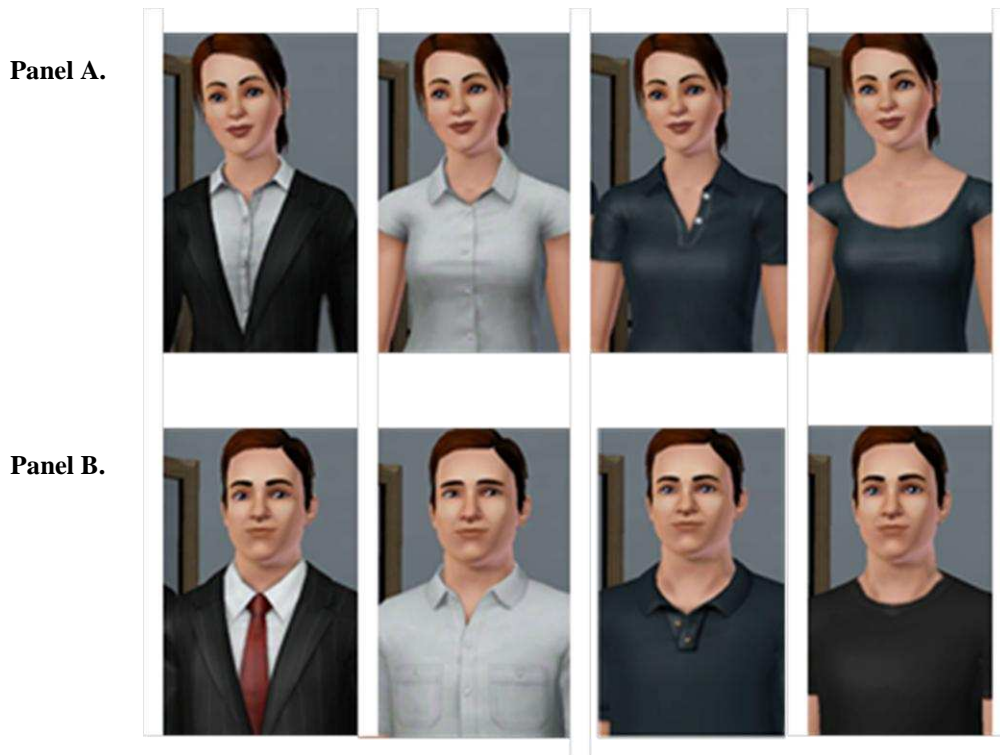
Panel A.

Panel B.

Figure 1. Panel A. The four female versions of the virtual characters; Panel B. The four male versions of the virtual characters

pressing the '♀' button and giving her subtle make-up and a complementary hairstyle. Once created, the examples were printed in color and individually mounted onto foam board so that participants could physically rank them.

3.3. Procedure

Participants were given an informed consent form detailing what they could expect during the interview, and their confidentiality was assured. They were asked preliminary questions about their experience with supermarket SSCOs. To begin the main part of the interview, participants were given either the male or female examples to rank in terms of formality and asked to clarify their reasons for their most formal and most informal choice. This was then repeated with the second set of examples. The interviewer was female and hand-recorded participant answers in a prepared matrix. Following each interview, participants were debriefed and thanked. The entire interview process lasted approximately twenty minutes.

4. Results

4.1. Dress Code

- Most participants identified a shirt or polo shirt as typical supermarket employee dress – in line with what participants suggested supermarket employees should wear; it was these options on the example VAs that were identified as making the character look more approachable and friendly.

- A tie was the most commonly identified difference in male formal dress, followed by a collar and suit jacket. The three most common features considered to differentiate female formal dress from male formal dress were more flexibility and variation, more color, and being able to wear a skirt or dress.

- The most common reasons for the t-shirt being chosen as the least formal for females was the absence of collar and the increased display of skin. For males, the primary reason was the absence of a collar.

- The shirt and polo shirt options were most commonly ranked as the middle options in terms of perceived formality; a suit was something participants believed was reserved for managers.

- Participants expressed a preference for consistent branding (e.g. logos and name-badges) as this was

deemed important for helping customers identify employees.

Other common suggestions about supermarket employee presentation related to cleanliness, comfort, and personal appearance (e.g. tattoos, piercings, and hair style), expressing a general preference for a practical but smart and clean appearance, and individuating physical attributes being acceptable in moderation (e.g. subtle make-up in women).

Participants were asked whether supermarket employee dress should apply to VA dress in a SSCO context. Seventeen participants answered 'yes' to this question. The two most common reasons for this were that it would aid consistency and that VAs should be recognizable as staff. Of the four participants who answered 'no' to the question, two said that this was because there was no need for the VA to represent a real person. Two also said that it was more important to design a tool that allowed the supermarket in question to customize its VA as deemed suitable. Another four participants stated that VAs should not look too photo-realistic, but should look like animated agents. Reasons given for this were that photo-realism may lead to high, unrealistic expectations of VA capabilities, and that it would be annoying.

Because there were four options for each VA gender, and no forced choice, participants often identified more than one dress type as appropriate for checkout staff and a VA. For this reason, the results were not statistically tested for significance. However, the main study aimed specifically to do this.

4.2. Gender

Participants were asked to state whether they would prefer working with a female VA or a male VA. Twenty of the twenty-one participants stated their preference or made a choice. It was inappropriate to carry out a test of independence between male and female participant choices because of the small sample size in combination with the unequal gender distribution. Instead, a Chi-Square for Goodness of Fit was performed (Table 1). More participants than expected by chance chose a female VA (15 v 10). A Chi-Square test demonstrates that the

Table 1. The preference for VA gender

	Male VA	Female VA
Observed	5	15
Expected	10	10

results are significant at the 5% level [$X^2 (1) = 5$; $p = 0.025$]. This means that 75% of participants would prefer to interact with a female VA.

Participants provided a range of reasons for this preference. A recurring opinion was that women in real life tend to be cheerier, more helpful, politer, nicer, easier on the eye, less imposing, friendly, easier to listen to, and more approachable – consistent with the 'warmth' dimension of SCMs (Fiske et al., 2002; Cuddy et al., 2007; 2008). These perceived traits make females appear more 'suited' to checkout assistant roles, reflected in the common anecdotal observation that working behind the tills in supermarkets is a female-dominated job. Based on this and the stated preference for consistency between face-to-face and virtual in-store channels, it stands to reason that customers would expect and prefer to see a female VA within a SSCO interface.

5. Discussion

The stereotype that helping behavior is a characteristic of femininity was expressed by most participants and highlights a desire for and tendency to seek out cues to role consistency. Overall, the findings suggest that gender-based stereotypes of high warmth and low competence in females may have underpinned the preference for a female VA. As stated, the primary proposed purpose of a VA would be to provide guidance during a transaction. It is conceivable that this role along with working behind the tills in general are both considered to require low skill and low competence.

The fact that participants identified the polo shirt and shirt/blouse as neither formal nor informal, as well as most appropriate for VAs and actual checkout staff (due to their impact on perceived friendliness), suggests that dress code preference is also based on the implied warmth of the person, more so than implied competence. In fact, many participants suggested that the less formal the clothing, the less trustworthy and/or competent the employee appeared. While participants perceived less formal choices as more appropriate for supermarket employees by making them appear more approachable, these choices did little for perceived credibility.

6. Main Study

The exploratory study was insightful but limited in many respects. None of the VA examples are shown from the same angle or look in the same direction. These factors could have had an impact on their perceived friendliness and approachability. Moreover, dress code was not completely comparable between the gender categories. For example, unlike the formal female, the formal male donned a tie. The female VA examples also tended to show more skin. While this was deemed appropriate given the norms of male and female apparel, it may have affected how the VAs were perceived. Dress also differed in color within the female and male sets, such that half had a white top (suited shirt and short-sleeved shirt), and half had a black top (polo shirt and t-shirt). This could have affected the perceived formality of clothing in a way we did not control for. Given the small sample size, these limitations could have had an impact on the outcome. The main study tackles these issues in the following ways:

1. All VAs are comparable in size, and gaze and head direction;

2. All VAs are comparable in terms of clothing items, size, and color;

3. There is a larger sample of participants.

Based on the described SCMs and the shifting standards model of stereotypes, two main predictions are made. These should be the same for male and female participants because stereotypes are informed by culture and influence people's behavior even when they do not personally or consciously advocate them (Crosby et al., 2007). First, due to the helping role of the VA and the gender-neutral nature of the context, a female VA should be chosen more than a male VA. Second, due to the need for a VA to display the appropriate competence in its role as a SSCO assistant, and the typical dress code of checkout staff, the more formal option should be chosen more often than the more informal option for all VAs. In line with the shifting standards model of stereotypes, it may be that formality is deemed more important for female VAs than male VAs, increasing perceptions of competence that she may be perceived to 'naturally' lack based on her implied gender.

7. Method

Visitors to a science center exhibiting robotics could interact with a SSCO simulation provided as a means of collecting data about VA preference (Figure 2). From a selection of eight randomly presented VAs, participants were asked to choose one. These VAs differed as a function of gender, realism, and formality of dress.

For comparison with the interview data which looked at three-dimensional VAs, we collated the frequency of preferences for the three-dimensional male versus female

Figure 2. A participant choosing one of the eight VAs which were presented in random order and differed in terms of gender, realism, and dress.

VAs and formality of dress. Examples of the differences between three-dimensional VAs based on gender and formality of dress can be seen in Figure 3.

The VAs were created in Autodesk Maya (3D) and Adobe Photoshop (2D) and displayed via bespoke software on a SSCO machine.

7.1. Participants

The study's participants were willing members of the public attending the Dundee Science Centre exhibition. A total of 578 adults between the ages of 16 and 84 chose a VA and provided their own gender. 390 of these (who ranged between the ages of 16 and 82) chose a three-dimensional version and these were used for statistical analyses of VA preference as a function of VA gender and

formality of dress. 164 of the participants were male, and 226 were female.

7.2. Materials and Procedure

A disclaimer was present both next to the SSCO and displayed on screen before the participant began. It stated that that their responses would be used for research. After reading the disclaimer and pressing 'Begin', participants were asked to choose their preferred VA (Figure 2). Following this, participants were asked to provide (optional) demographic information (Figure 3) and were then engaged in the entertainment part of the attraction – a series of reaction time tasks which they could end at any point.
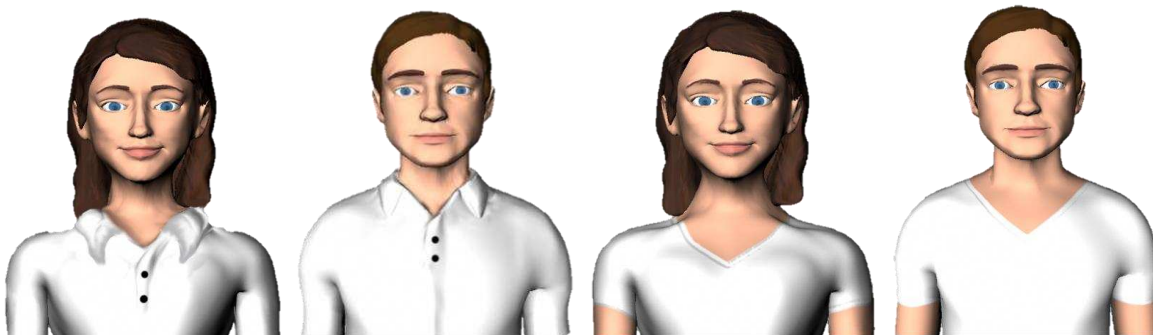

Figure 3. From left to right: Formal Female; Formal Male; Informal Female; Informal Male.

Figure 3. Screenshot: Some of the demographic questions.

Table 2. The preference for VA gender

	Male VA	**Female VA**
Observed	115	275
Expected	195	195

8. Results

8.1.1. VA Gender. Table 2, shows that more participants than expected by chance chose a female VA (275 v 195). The Chi-Square demonstrates that the results are significant at the 5% level [X^2 (1) = 65.641; p < 0.001]. This means that 70.5% of participants chose to interact with a female VA, which replicates what was found with the interview data.

Unlike the interview data, it is possible to carry out a multi-dimensional Chi Square test to determine whether the pattern of VA gender choice was independent of participant gender. A 2x2 multi-dimensional Chi-Square test revealed a relationship between the three-dimensional VA's implied gender and participant gender [X^2 (1, N = 390) = 41.513, p < 0.001] with a moderately strong association [Φ = 0.326]. The results are depicted in the table below (Table 3). The majority (approximately 83%) of females chose a female VA, compared to nearly half (53%) of males.

8.1.2. VA Dress Code. Unlike what was possible with the interview data, the main study allows similar analysis to be carried out on VA dress code (formality). A Chi-Square demonstrates that the results are *not* significant at the 5% level [X^2 (1) = 3.323; p = 0.068]. A separate 2x2 multi-dimensional Chi-Square testing the relationship between VA formality of dress and participant gender was also non-significant [X^2 (1, N = 390) = 0.014, p = 0.907], and there was no association between formality of dress and VA gender [X^2 (1, N = 390) = 1.15, p = 0.284].

Table 3. The Count and Percentages of Male and Female Preferences for VA Gender

	Participant Female	**Participant Male**	**Total**
VA Female	188 (83.2% of females)	87 (53% of males)	275 (70.5% of total)
VA Male	38 (16.8% of females)	77 (47% of males)	115 (30.6% of total)
Total	226	164	390

9. General Discussion

Initially, the findings appear to support the predictions drawn from the original SCM and BIAS map framework – that there would be a preference for a female VA, the logic being that females are perceived as warmer and therefore more approachable than males. However, further analysis showed this to be true only for female participants which poses questions about whether the perceived warmth of a female VA affected this preference or whether other factors were at play. Alongside the SCM and BIAS map framework, the shifting standards model of stereotypes would predict a preference for a female VA to be dressed more formally in order to communicate competence, but this was not the case; there seemed to be no preference for either formal or informal VAs as a function of VA or participant gender.

The results do not support Cowell and Stanney (2005) who found that most female participants preferred a character of the opposite sex. Baylor and Plant (2005) report the same general trend, but only when female participants were asked to choose an agent to teach them about a male-dominated topic; when learning about engineering was not the purpose of the agent, participants chose to gender-match. It is unlikely that "male expertise" was perceived as necessary in this SSCO context, and thus, the female preference for a female VA is in line with Baylor and Plant (2005).

It can be argued that because women tend to be more expressive than men, pay more attention to nonverbal cues, and to be more accurate at decoding them (Cross & Madson, 1997; Gong, 2003; Vigil, 2009; Qiu & Benbasat, 2010), female participants were more sensitive to the gender of VAs, and therefore more likely to identify with the female options. Based on this reasoning, Qiu & Benbasat (2010) argued that women should be more sensitive to demographic information than men. Therefore, while the results do not replicate Qiu & Benbasat's (2010) findings in terms of gender, their initial argument may still apply.

Moreover, women seem particularly adept at categorizing ambiguities in female facial expressions in terms of submissive (non-threatening) cues, such as sadness and fear (Vigil, 2009). This brings stereotypes back into the equation. Women may still have been affected by stereotypes of femininity, preferring female VAs not because they were deemed 'appropriate' due to these stereotypes but because heightened sensitivity to stereotypes of warmth increased female participants' comfort with interacting with female VAs. This comfort is reflected in research that shows that women place more value in the social bonding and relational aspects of their experiences than men (Cross & Madson, 1997), and tend to prefer fewer but more intimate relationships with other women, whilst men maintain larger social networks consisting of less intimate relationships with both men and women (Caldwell & Peplau, 1982; Vigil, 2009).

Men may also have been aware of stereotypes of warmth attached to the female VAs, but chose not to use this in the their VA decisions in this particular context. Kim and Wei (2011) found gender-matching effects for both male and female participants in a male-dominated domain. It could be that male participants in the current investigation would have chosen to gender-match more had the task been perceived to require male expertise. Since males tend to form stricter dominance hierarchies than females (Vigil, 2009), a male-dominated environment may have motivated male participants to choose a VA whose gender was 'appropriate' given the context. Instead, the results indicate that due to the gender-neutral nature of the SSCO task, some males were more open to paternalistic attitudes towards women (Cuddy et al., 2007; 2008). While this involves stereotypes of femininity, it manifests in an increased liking for traditional women (Fiske et al., 2002) and possibly idealization of the opposite sex and associated traits, e.g., warmth and nurturance (Rudman & Goodwin, 2004) in general, as opposed to informing specific judgments about the sorts of male- versus female-appropriate roles VAs should play. We believe that this occurred alongside an in-group (male) bias resulting in a lack of overt preference for either gender. It may even be that some men were fully aware of stereotypes of female warmth and male competence, but deemed neither especially important because the VA was not thought valuable to their interaction with the SSCO, therefore choosing a VA at random.

The results with regards to formality of dress are harder to explain. In both human-human and human-computer interaction, the appropriateness of a sales assistant's dress depends on the type and place of work. However, the current study found no direction of preference for dress code either as a function of VA gender or participant gender, and no preference overall. McBreen et al. (2001) identified a preference for smartly dressed 'banking' agents and casually dressed 'cinema' agents. It could be that SSCOs sit in-between cinema and banking applications in terms of the perceived importance and seriousness of context, therefore eliciting no preference for either formal or informal choices. It could also be that the clothing categories were either too similar in appearance, i.e., both white and inconspicuous, and

therefore not noticed or used in VA decisions, or too similar in formality, i.e., similarly casual, and therefore not important to users in their decisions. This is something that needs to be explored in more detail.

10.   Conclusions

The current investigation attempted to investigate preferences for three-dimensional 'male' and 'female' VAs dressed according to two different levels of formality. Overall, the findings do not lend strong support to the SCM or the BIAS map framework, even though gender stereotypes were repeatedly drawn on in the exploratory semi-structured interviews. This does not imply that stereotypes of men and women were not activated, or that formality of dress is unimportant. Rather, it suggests that stereotypes had an impact on personal preferences for interacting with one sex over the other, rather than ideas about gender 'appropriateness' given the SSCO context.

Specifically, we suggest that women chose female VAs because they seek and maintain intimate relationships with same-sex others (Caldwell & Peplau; Vigil, 2009) who are perceived to possess high warmth and low threat (stereotypes of femininity) (Fiske et al., 2002; Cuddy et al., 2007; 2008). Meanwhile, within-sex bias (resulting in passive and active facilitation, see Cuddy et al., 2007; 2008), alongside a preference for opposite sex interaction and paternalism (resulting in active facilitation alongside passive harm) may have been jointly responsible for the disparity in male participants' VA choices. Future related work should aim at collecting the reasons behind the choices for male versus female VAs, and whether participants even remember which VA they chose. It may also be insightful to determine whether participants would continue to choose the same VA on subsequent interactions with the technology, or whether preferences change over time. Finally, it would be useful to determine whether participant performance on a SSCO-related task is the same regardless of VA gender and style.

Limitations with the study are associated with a lack of ecological validity since the SSCO exhibition was an attraction in a science center and not a true replication of an actual self-checkout experience. There was also a lack of control over the data collection process compared to a more lab-based setting since we relied on self-reports and had to assume that each participant took part only once. However, this lack of control should be offset by the large sample. A key remaining limitation could be the nature of the formal versus informal clothing which may have been too similar or two inconspicuous. It remains to be seen whether a clearer and more diverse choice in clothing might affect the results in future. To move beyond the mere embodiment of interface agents as a means of enhancing social presence, we need to continue research into specific physical attributes of these agents such that the positive impact of social presence is maximized given the user demographic and technology context.

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