User Demographics for Embodiment Customization

Andrew J. Cowell¹, Kay M. Stanney²

¹Pacific Northwest National Laboratory, MSIN K7-28, 3350 Q Ave, Richland, WA, 99352
²IEMS, University of Central Florida, CEBA 249 Orlando, FL 32816
¹andrew@pnl.gov ²stanney@mail.ucf.edu

Abstract
Attempts at interface agent personalization are usually aimed at helping the user perform a task or service. For example, scheduling of appointments, inspection of messages, discovering items of interest and different forms of negotiation. While this is very noble undertaking, it makes assumptions about the level of trust and credibility a user may place in such an agent in a real world setting. If Microsoft’s experiments in social user interfaces teach us anything, it is that a ‘one size fits all’ solution does not truly engage the user and encourage reuse. This ‘relationship management’ between the user and the character begins when the two first meet. As with human-human relationships, first impressions are essential. Instead of looking at the functional aspects of the relationship, we believe the characters embodiment is the best place to start the personalization process. We describe a study in which participants from several different age ranges, genders and ethnic groups were asked their preference of anthropomorphic character, based on a cooperative computer task. We found that participants generally selected characters from the same ethnic group as themselves and that almost all participants selected a young character (instead of a middle aged or elderly character). No significant preference was found for character gender.

Elements of Embodiment
A user’s judgment of an anthropomorphic character, if embodied naturally and realistically, can be assumed to be based upon the same logic as used in everyday interactions with other individuals. Such judgments are commonly based upon stereotypical beliefs that one holds of the referent’s social category or categories. This process of forming an impression of a referent begins with an act of categorization (Fiske & Neuberg, 1990) after which stereotypic processes commence. A target may be categorized on a number of dimensions (for example gender, age, ethnicity, hair length, accent, music preference, etc.) and belong to multiple categories simultaneously. Stereotypes exist for broad categorizations such as ‘males’ as well as more narrowly defined groups such as ‘long haired, young males’. Certain researchers (Fiske & Neuberg, 1990; Smith & Zarate, 1992) believe stereotypes occur at more than one level with the most specific subtype being the individual. While an individual may be considered a combination of multiple dimensions, an observer is not necessarily aware of all the possible dimensions, restricting their observation to a small set of obvious base characteristics, such as age, gender and ethnicity (Gardner, MacIntyre, & Lalonde, 1995). In our study, we took these three characteristics to be the fundamental elements of our character embodiment. Age, gender and ethnicity dimensions are discussed here with the purpose of identifying differentiation, if any, in preferred embodiment based on one’s own demographics.

Gender
The psychological literature indicates certain gender stereotypes are pervasive in common culture. Even despite recent upward trends in female social standing (Romer & Cherry, 1980; Ruble, 1983), men continue to be perceived as possessing stronger, functional attributes, such as independence and assertiveness, while females are perceived to hold more emotionally expressive characteristics, such as kindness, sensitivity and need for affiliation (Rosenkrantz, Vogel, Bee, Broverman, & Broverman, 1968). From these perceived attributes evolve several stereotypes. Robinson and McArthur (1982) found that both men and women attend to male voices more intently than to females voices. This may indicate that computer characters should be embodied as male characters to utilize the increased attention they appear to demand. Based upon the perceived knowledge that the genders have over their own characteristics described above (i.e. functional attributes for males, expressive attributes for females) it is often suggested that females know more about typically feminine topics while males know more about typically masculine topics. Heilman (1979) found that certain occupations were commonly identified as being either feminine or masculine. Due to gender stereotypes, entrance to masculine careers is often difficult for females and visa versa. Deaux and Emswiller (1974) found that performance by a male on a masculine task was substantially attributed as skill while the same task completed by a female was attributed to luck. A similar study by Feldman-Summers and Kiesler (1974) found that male success was rationalized as high ability while motivation and luck accounted for female success. In human-agent interaction, the context of the application or shared task would be where attribution of masculinity or
femininity would lie. For example, if the shared task were to determine faults with a car engine, the stereotypical context would be of a masculine task, whereas if the shared task were flower arrangement the stereotypical context would be of a female task.

Dominant behavior is another area where gender stereotypes exist. In females, dominance and aggressiveness are regarded as undesirable, whereas they are permissible and even encouraged in males (Costrich, Feinstein, Kidder, Maracek, & Pascale, 1975; Deutsch & Gilbert, 1976). Nass, Moon and Green (1997) describe males placed in dominant roles as “assertive” and “independent”; whereas females are seen as “pushy” or “bossy” (p. 865). Such gender affects could cause unfavorable evaluations regardless of the quality of an agent’s work.

As part of the ‘Computers As Social Actors’ program at Stanford University, Nass, Moon and Green (1997) performed studies to determine whether computers embedded with gender cues would generate gender-based stereotypic responses. Their results indicated strong support for the ‘male evaluation’ stereotype. Both male and female participants rated a male-voiced computer more positively than a female-voiced computer. Their work also supported the ‘masculine/feminine’ stereotype, although the results were less definite. Finally, they supported the ‘female dominance’ stereotype, showing that female-voiced computers that interacted in a dominant fashion were rated as significantly less friendly as compared to their male-voiced counterparts.

At first glance, this work appears to suggest that an agent should be embodied as a male character to ensure successful interaction. A male character may be attended to more intently, and may not be penalized if it acts in a dominant manner. A male-embodied agent may suffer in feminine contexts (i.e. users’ may question the agents’ expertise), although Nass, Moon, and Green found a relatively weak effect. Such a decision would coincide with findings in a study by Mack et al (1979) that found that virtually all males (98%) and a high percentage of females (85%) attributed male characteristics to a standard computer. Unfortunately, this research is inconclusive. None of this previous research has been based specifically on realistic anthropomorphic agents. It is possible that a referent may make a different choice when presented with an geometrically accurate embodiment, versus a computer that speaks with a male or female voice (Nass, Moon & Green, 1997) or a computer that makes no effort to engender itself (Mack et al, 1979).

**Ethnicity**

Ethnicity is another demographic variable that is easily discernable early in an interaction cycle. Ethnic stereotypes are often depicted on television and new media where the ethnic spectrum is not homogeneous, with Caucasian’s appearing much more frequently than any other ethnic group. While African Americans appear more frequently then they once did, they are often depicted negatively, as criminals or perpetrators of violent crime (Gerbner, Gross, Morgan, & Signorielli, 1986). A similar stereotype was found in a report from the University of Washington that compared the probation reports of black and white juveniles. Black individuals charged with the same crime, of the same age and having the same criminal history as a white individual would have their crimes described as being caused by internal attributes or aspects of their character (e.g. being disrespectful toward authority or condoning criminal behavior) while the white juveniles’ crimes would be more likely blamed on negative environmental factors (e.g. exposed to excessive family conflict or association with other delinquents). A study by Peffley et al (1997) found similar negative stereotypes in the context of state welfare. Even though many individuals would not admit to harboring such negative stereotypes, they are common and affect the manner in which people interact with individuals from another ethnic group. Such ethnic stereotypes may be extended to computer characters at the user interface.

While such literature suggests that an African American embodiment for a computer character would be an unwise choice, a growing section of literature suggest that African Americans hold their own racial stereotypes. Often labeled as ‘reverse racism’, a growing body of literature indicates ethnic stereotypes are reciprocal (Jaroff, 1994; Fish, 1993; Gross, 1977; Lynch, 1989; Horowitz, 2000).

Another ethnic group to consider are Asian Americans. Generally, the ethnic stereotypes describing Asian Americans are not as negative as those describing African Americans although they can be just as damaging. Many see Asian Americans as the model minority (Delener & Barlow, 1990) and “academic nerds” (“Asian Americans: The Drive To Excel”, 1984 p.12), symbolizing educational achievement and economic success. Such stereotypes misrepresent the majority of Asian Americans and lead to racial envy and, in some cases, violence (Yip, 1997). In technological circles, such academic achievement stereotypes have been extended to portray Asian Americans as computer gurus (Taylor & Stern, 1997).

Yet another ethnic group to consider are Hispanic (Latino) Americans. A review by Jackson (1995) suggests that perceptions of Hispanics are generally unfavorable. Hispanics are often viewed as lazy, cruel, ignorant and belligerent but also as family-oriented and tradition-loving (Fairchild & Cozens, 1981). Similarly, a study by Marin (1984) administered to Anglo Americans saw Hispanics as aggressive, poor and lazy, but also family-oriented and proud. Studies indicate that Hispanics use similar stereotypes when describing themselves (Montenegro,
1971; Peterson & Ramirez, 1971) and Horowitz (2000) suggests this may be true for all ethnic groups.

While it is not the intent of this study to perpetuate ethnic stereotypes, it is prudent to acknowledge them and their role in human-human communication. All ethnic groups appear to harbor their own out-group prejudices. They also use similar stereotypes for people of their own ethnic group.

**Age**

While many studies in human-computer interaction (HCI) look at how age affects the manner in which an individual interacts with a computer system, few studies were found that look specifically at how age affects interaction and specifically how the age of a computer character affects credibility. De Meuse (1987) indicates that a ‘similar to me’ hypothesis exists and this was supported in certain studies. Rosen and Jerdee (1976) found that young managers saw older personnel as more resistant to change, less creative, possessing a lower physical capability for work and less suitable for retraining. Cleveland and Landy (1981) reported that older workers were rated low on ‘self development’ and ‘interpersonal skills’ by younger workers. Contrary to this, a study by Schwab and Heneman (1978) found that older employees rated older secretaries lower in ability than younger ones. This suggests there exists some age function that describes the preferred age of an interacting partner. For preteen users, there appears to be a ‘big brother’ mapping where the user prefers a character that is ‘older and wiser’ (Johnson, 1995). Teenage users and users up to their late twenties may feel more comfortable interacting with a character of the same age. If the character were any younger, the user may question their domain knowledge, but if the character were any older it may be consider too old fashioned and out of date (Benford, 1998). Older users may prefer a younger character. They may regard a computer character their own age as knowing as little as they do about technology and thus being of little help. As younger generations are usually associated with being at ease with new technology, older users may believe they make the best computer associates (Benford, 1998). This collective research suggests that an age function may exist that potentially directs users of all ages to select a youthful computer character.

To empirically substantiate the hypotheses put forth in this study, a set of experiments was conducted. An experiment was performed to determine the preferred demographic embodiment and the results of this were filtered into a larger experiment that sought to determine the level of trust and credibility a participant would confer on a character based on differing levels of nonverbal behavior.

**Empirical Study**

The purpose of the pretest was to determine the preferred agent embodiment for the computer character. Unlike the behavioral mechanisms that agents may use when interacting with users, physical embodiment cannot be dynamically changed during an exchange. Hence a method was required to determine the best design practices for the selection of demographic variables considered in this dissertation (gender, age and ethnicity of a computer character). The hypotheses for this pretest were driven by the inconclusive suggestions from the literature review.

**Hypotheses**

The following hypotheses are offered (alternative hypotheses in braces):

\[ H_{a1} : \text{A computer character that matches the ethnicity of the user shall [not] be seen as a more preferable interaction partner than a character that is not from the same ethnic group.} \]

\[ H_{b1} : \text{A computer character embodied as a youthful character will [not] be seen as a more preferable interaction partner than a character that is embodied as one of the other age presets (middle-aged/elderly).} \]

\[ H_{c1} : \text{A computer character embodied as a male character will [not] be seen as a more preferable interaction partner than a character that is embodied as a female character.} \]

**Method**

The experimental task was a card sorting assignment. Cards featuring characters describing all 18 permutations of the three demographic variables, as shown in the table below, were shown to pretest participants and they were asked to sort them in order of which character they would prefer to work with in a cooperative computer task.

<table>
<thead>
<tr>
<th>Age</th>
<th>Gender</th>
<th>Ethnicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young</td>
<td>Female</td>
<td>African American</td>
</tr>
<tr>
<td>Middle Aged</td>
<td>Male</td>
<td>Asian American</td>
</tr>
<tr>
<td>Elderly</td>
<td></td>
<td>Caucasian</td>
</tr>
</tbody>
</table>

An example character (a middle aged Caucasian female) is shown in Figure 1. A Latino/Hispanic character was also
The character was left to participant choice. Results of the study, the final characters were matched to the ethnicity of the participant, and a young character was used throughout. The participants were asked to select between a male and female character. Informal feedback from the participants indicated that the characters’ embodiment was natural and genuine. Those who had interacted with other types of interface agent expressed a preference for our anthropomorphic, realistic embodiments.

This study provides some potential design guidelines that may help direct embodiment decisions for those interested in using anthropomorphic computer characters in their applications. The essence of the guidelines is that research across sociology, psychology, social psychology and political science provides good indicators of how an individual’s demographic profile influences an interactional dyad and further supports the premise that there is transfer between human-human communication and human-computer characters when embodied realistically.

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References


Results

Forty-five college students from the University of Central Florida participated in the experiment. These included twenty males and twenty-five females. The group included twenty Caucasians, nine Asians and sixteen African Americans. The participants ranged in age from college to middle aged. For each demographic element, the participants preferred choice was compared to their own demographic values and a match or no-match recorded. For each variable, a test of proportions was used to determine participant preference. Results indicated that a significant (p = 0.05) majority of participants selected a character matching their ethnicity and that was young (based on the task being a cooperative computing endeavor). While most participants selected a character that was opposite of their gender, this difference was not significant. Based on these results, the ethnicity of the character for the main experiment was set to match that of the participant, the age of the character was set to ‘young’ and the gender of the character was left to participant choice.

Conclusion

The empirical study discussed in this paper was used as a pre-test for a more in-depth study of the use of trusting nonverbal behaviors by computer characters to encourage a more credible interaction (Cowell, 2001). Based on the

Figure 1 - A Middle Aged Caucasian Female Embodiment

included initially, but withdrawn before testing began due to difficulties in expressing significant differences between this and the appearance of the Caucasian character. All characters shared the same neutral hair, eye and clothes colors to reduce preference selection to the elements we were controlling.


