

Which Pedagogical Agent do Learners Choose? The Effects of Gender and Ethnicity

Amy L. Baylor, Ph.D. (baylor@coe.fsu.edu)

E Shen (ess0086@garnet.fsu.edu)

Xiaoxia Huang (xh02@garnet.fsu.edu)

PALS (Pedagogical Agent Learning Systems) Research Laboratory
Florida State University
United States

Abstract: This study examined how learners' gender and ethnicity influenced their choice of pedagogical agents how they perceived the persona of the chosen agents. 183 undergraduates from two southeast universities participated in the study and were provided eight agents to choose from, each differing by gender (male, female), ethnicity (African American, Caucasian), and realism (realistic, cartoon). The results showed that African-American learners were significantly more likely to choose an agent with the same ethnicity and also to have positive attitudes toward the chosen agent after learning from it. Overall, the perceived agent demeanor was the most cited reason for why learners chose a particular agent. Female learners were more likely to choose a cartoon-like (as opposed to realistic) agent than male learners and were also more likely than males to choose an agent based on their previous experiences with human instructors.

Introduction

Intelligent agents are independent computer programs operating within software environment such as operation systems, databases, or computer networks (Roesler, 1994). For educational purposes, pedagogical agents can be presented to the learner as a believable character, serving a mediating role among people and programs, or performing a role of intelligent assistant (Bradshaw, 1997). Learners working in agent based learning environment have been shown to have higher motivation and greater learning (Moreno, Mayer, Spires, & Lester, 2001). Given that research has demonstrated that ethnicity and gender biases would have the potential to cause adverse effects on student learning and self-esteem (Sadker, 1999), it would be expected that a key issue impacting learner motivation would be the relationship of the learners' and agents' ethnicity and gender. Given that it is relatively easy to manipulate the gender, ethnicity, and realism of a pedagogical agent, results in this area have high potential for immediate impact. In this study, the following questions were examined:

- 1) How does the learner's gender and ethnicity relate to their choice of agent (by agent gender, ethnicity, and realism)?
- 2) After learning from the chosen agent, how does the learner's gender and ethnicity impact how they perceive the agent's persona?

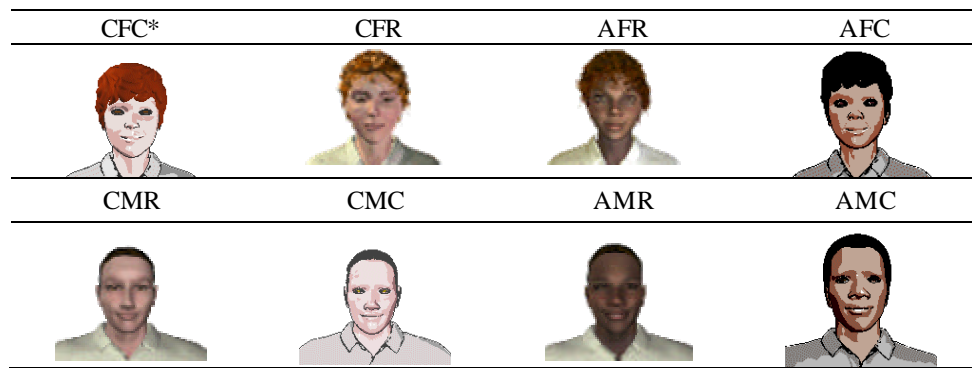
Methods

Participants

183 undergraduate students (39.8% male and 61.2% female; 54.1% Caucasian and 37.2% African American) enrolled in a computer literacy course in two public southeast universities participated in this study. One of the two universities is a traditional African American student University. The average age of the participants was 20.45 years old (SD=2.49).

Agent Format

Eight three-dimensional pedagogical agents were developed in Poser to represent the three agent characteristics: ethnicity (African-American and Caucasian), gender (female and male), and realism (real and cartoon). The agents (see below) were created by a graphic artist from the same facial image differed only in skin color, hair color, and details of the face structure in order to represent ethnicity, gender and realism. Each agent had identical scripts, identical lip-syncing, and identical basic animation. Each female agent had identical voice, so did each male agent. Given that prior research has suggested that the optimal condition is for voice narration to be presented together with the corresponding text as a way to reduce cognitive load and improve learning (Moreno & Mayer, 2002; Mousavi, Low, & Sweller, 1995), a text bubble was presented together with the agent's spoken narration in all eight conditions.



*First Letter: C = Caucasian A = African-American
 Second Letter: F = Female M = Male
 Third Letter: C = Cartoon R = Real

Procedure

During the study, the learners participated in a simplified version of the MIMIC (Multiple Intelligent Mentors Instructing Collaboratively) agent-based research environment with content regarding coping with college life. After providing demographic information, the learners were asked to “pick the instructor you would like to learn from” The agent images were presented as shown in Figure 1. After the learners chose the agent instructor, they were asked to answer the open-ended question “why did you choose this instructor?” Once the participants completed answering the question, the chosen agent instructor started giving a presentation on coping with college life. After the presentation, the learners answered posttest questions regarding Perceived Agent Persona. It took approximately 20 minutes on average for the learners to complete the task.

Measures

As indicated below, measures were implemented to collect additional information regarding the learner’s choice of agent and the learner’s perception of agent (Perceived Agent Persona) after learning from it.

Reasons for choice

Learner responses to the open-ended question “Why did you choose this instructor?” were analyzed to see whether any patterns could be identified. Each learner’s response was examined and coded. The first-level coding was to differentiate learner responses by highlighting similar responses with the same color, different colors indicating different meaning units. The second-level coding was to categorize learner’s responses by giving each meaning unit a label which summarized the meaning unit. The number of occurrences of each category were calculated with the associated percentage.

Perceived Agent Persona

Four sub-scales from the API (Agent Persona Instrument) (Baylor, 2003b) were used to assess the perceived agent persona in terms of how much it was *Facilitating Learning*, *Credible*, *Engaging*, and *Human-like*. The Cronbach’s alpha for the overall reliability of the instrument was assessed at 0.97.

Results

Choice of agent

From the frequency table below, we may note the following trends:

- African-American female participants tended to pick African-American female realistic agent (50%), followed by African-American male realistic (15.9%) and Caucasian male realistic agent instructor (13.6%).
- African-American male participants tended to pick African-American female realistic agent instructor (50%) and African-American male realistic agent instructor (35%).
- Caucasian female participants tended to pick Caucasian female realistic (24.2%) or Caucasian male realistic agent instructor (29%).
- Caucasian male tended to pick African-American realistic female agent instructor (24.3%), African-American realistic male (24.3%), and Caucasian realistic female agent instructor (21.6%).

			CFC*	CFR	AFR	AFC	CMR	CMC	AMC	AMR	
Learner Gender	Female	Learner Ethnicity	Caucasian	2 (3.2%)	15 (24.2%)	10 (16.1%)	1 (1.6%)	18 (29.0%)	2 (3.2%)	8 (12.9%)	6 (9.7%)
		African American	1 (2.3%)	1 (2.3%)	22 (50.0%)	2 (4.5%)	6 (13.6%)	1 (2.3%)	4 (9.1%)	7 (15.9%)	
Sum			3 (2.8%)	16 (15.1%)	32 (30.2%)	3 (2.8%)	24 (22.6%)	3 (2.8%)	12 (11.3%)	13 (12.3%)	
Male	Learner Ethnicity	Caucasian	1 (2.7%)	8 (21.6%)	9 (24.3%)	1 (2.7%)	5 (13.5%)	2 (5.4%)	2 (5.4%)	9 (24.3%)	
		African American	0 (0.0%)	1 (4.2%)	12 (50.0%)	0 (0.0%)	3 (12.5%)	0 (0.0%)	0 (0.0%)	8 (33.3%)	
Sum			1 (1.6%)	9 (14.8%)	21 (34.4%)	1 (1.6%)	8 (13.1%)	2 (3.2%)	2 (3.2%)	17 (27.9%)	
Caucasian (male + female)			3 (3.0)	23 (23.2%)	19 (19.2%)	2 (2.0%)	23 (23.2%)	4 (4.0%)	10 (10.1%)	15 (15.2%)	
African-American (male + female)			1 (1.5%)	2 (3.0%)	34 (50%)	2 (3.0%)	9 (13.2%)	1 (1.5%)	4 (5.9%)	15 (22.1%)	
Sum			4 (2.4%)	25 (15.0)	53 (31.7)	4 (2.4%)	32 (19.2)	5 (3.0%)	14 (8.4%)	30 (18.0)	

Note: Sixteen participants were excluded from the data set in this table because they were neither Caucasian nor African-American.

To further determine the relationship between the learner's ethnicity/gender and their choice of the agent instructor (by agent ethnicity/gender/realism), three two-factor (learner's ethnicity and gender) logistic regressions were conducted: one for the agent instructor's ethnicity, one for agent instructor's gender, and one for agent instructor's realism. The results are shown below.

Predictor	Agent Ethnicity			Agent Gender			Agent Realism		
	β	S.E.	e^{β}	β	S.E.	e^{β}	β	S.E.	e^{β}
Learner Ethnicity	1.62***	.37	5.04	.40	.32	1.49	.60	.46	1.83
Learner Gender	-.55	.37	.58	-.07	.32	.93	-.84*	.50	.43
Constant		-1.27			-.27			-1.78	
χ^2		23.41			1.63			4.85	
df		2			2			2	

Note: Both learner gender and agent gender were coded as 0 for female 1 for male. Both learner ethnicity and agent ethnicity were coded as 0 for African-American and 1 for Caucasian
Agent realism was coded for 0 as real and 1 as cartoon
*** $p < .01$ ** $p < .05$ * $p < .1$

In the regression for the agent instructor's ethnicity, the overall relationship was statistically significant with the likelihood ratio test at the .05 level ($G^2 = 23.41 \chi^2(.05; 2) = 5.99 p < .001$), indicating that learner tends to choose an agent of the same ethnicity. In the regression for the agent instructor's realism, the overall relationship was statistically significant with the likelihood ratio test at the .05 level ($G^2 = 4.85 \chi^2(.01; 2) = 4.60 p < .1$), indicating that female learner tends to choose the cartoon agent.

Open-ended question

Eight themes emerged after our coding of learner responses as to why they chose the agent they chose, which were: agent ethnicity, agent gender, how realistic agent looks, agent demeanor (i.e. personality), agent appearance, instructor-related characteristics, learner's previous experience, and agent age.

Our further analysis resulted in the following findings:

1. Perceived agent demeanor was the most frequently mentioned reason for learners' choice of agent instructors, followed by agent gender, instructor-related characteristics, agent ethnicity, agent appearance, learner's previous experiences, agent age, and how realistic agent appears.
2. African American learners were more likely to choose an agent that they could 'better relate to' in terms of ethnicity and gender. For example, 31.7% African-American learners chose an African-American agent stating explicitly that they chose him/her based on his/her ethnicity, while only 4% Caucasian learners chose an agent based on the same reason. Similarly, 33.3% African-American learners chose an agent with a consideration of his/her gender, compared with 15% Caucasian learners doing so.
3. Female learners (10%) were more likely than male learners (3%) to choose an agent based on their previous experiences with human instructors in terms of gender, ethnicity, or appearance.

Perceived agent persona

Perceived agent persona was analyzed through a two-factor MANOVA, with the four sub-scales *Facilitate Learning*,

Credible, Human-Like, and Engaging as the dependent measures, and with participant's ethnicity (African-American, Caucasian) and gender (female, male) as the two between-subject factors. The two-factor MANOVA indicated that there was an overall significant effect of the ethnicity on perceived agent persona, Wilk's Lambda = .93, $F(4,133) = 2.41$, $p = .05$. Follow-up univariate analyses (ANOVA) indicated that significant differences occurred in all four sub-scales: *Facilitate Learning, Credible, Human-like, Engaging*. Specifically, African-American participants reported that the agent instructor they chose was more facilitating of learning than Caucasian participants, $F(1, 136) = 5.16$, $p = .01$. African-American learners reported that the agent they chose was more credible than Caucasian learners, $F(1, 136) = 5.35$, $p < .001$. African-American learners reported that the agent instructor they chose was more human like than Caucasian learners, $F(1, 136) = 3.77$, $p = .04$. African-American learners reported that the agent instructor they chose was more engaging than Caucasian learners, $F(1, 136) = 5.03$, $p = .02$.

Discussion

The most consistent finding of this study was that African-American learners tended to choose an agent of the same ethnicity more so than Caucasian learners. When asked as to the reason for their choice, African-American learners reported that they could 'better relate to' the agent in terms of its ethnicity and/or gender. For example, one African American female learner wrote: "I picked this instructor because I like to learn from someone that looks like me, race and gender. An African-American woman can relate to me better." Similarly, one African American male learner wrote: "African American male teachers relate better to young African American learners."

Additionally, it is of interest that African American learners perceived the agent instructors they chose more positively in terms of key persona factors (engaging, credible, instructor-like, facilitating learning). Other interesting findings of the study are summarized below.

In terms of learner gender:

- Female learners tended to choose the cartoon version of the agent instructors than males.
- Female learners were more likely than males to choose an agent instructor based on their previous experiences with human instructors.
- Male learners were more likely than females to choose an agent instructor based on the instructor-related characteristics of the agent.

In terms of learner ethnicity:

- Caucasian learners were more likely than African American learners to choose an agent instructor based on how realistic the agent appears.
- African American learners were more likely than Caucasian learners to choose an agent based on the instructor-related characteristics of an agent.

This study may have some implications for the design of agent instructors. It seems necessary to consider the learner's ethnicity and gender and the corresponding agent's ethnicity, gender, and realism. Further research is necessary to replicate these preliminary findings.

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