# Educational Potentials in Visually Androgynous Pedagogical Agents

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**Abstract.** We report a study on student's attitudes to a visually androgynous in comparison to a male and a female Teachable Agent (TA). Results were that overall the androgynous agent was preferred over the female and male agents. A visually androgynous agent does not embody categorical gender attributes. At the same time it does not have to be *genderless* but instead represent *both* maleness and femaleness so that students can chose for themselves. Androgyny, in this sense, is potentially a way to have femaleness and maleness represented, with corresponding educational benefits such as role modelling and identification, without risking negative reinforcement of gender stereotypes.

**Keywords:** pedagogical agent, teachable agent, androgyny, visual appearance.

## 1 Introduction

The impact of role models and identification in educational contexts is well established. Bandura [1] highlights the significance of similarities between a role model and a learner and points out gender as a crucial dimension. A number of studies have explored the impact of visual gender in terms of male versus female pedagogical agents. For instance, the use of virtual coaches portrayed as young females increased the willingness of female students to choose technically oriented courses and helped increase their self-efficacy [2]. But there were drawbacks. The female student's positive attitudes seemed to stem from a conception of a female engineer being less competent than a "real, typical male engineer". They reasoned along the line "If she is able to do it, I can do it!" [2]. Thus the short-term pedagogical benefits of recruitment and boosted self-efficacy in female students were accompanied by a long-term pedagogical drawback in reproducing and reinforcing – not changing – gender stereotypes and prejudices. In the study presented in this paper a humanlike visually androgynous agent was compared with a female and a male agent in terms of students' attitudes toward the agents. The rationale for the study was the following question: Is it possible to retain the benefits of gender in pedagogical agents, in terms of identification and role models, but avoid or diminish the drawbacks in terms of reinforcement of gender stereotypes including a high amount of abuse towards female agents [4].

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## 2 Study

The pedagogical agent is a Teachable Agent (TA), i.e. a digital tutee, situated in an educational math game that trains basic arithmetic skills with a focus on grounding base-ten concepts in spatial representations [3]. The TA engages in on-task activities with the student – board games and multiple choice conversations regarding math as trained in the game – as well as in free off-task conversation in natural language in a social chat.

The study explored the following questions: How would a visually androgynous vs. a visually gender stereotypical TA affect students' attitudes towards the TA (i) as their tutee?" and (ii) as their social chat partner?

The three agent representations used in the study are shown in Fig. 1. All three representations were pre-validated in terms of gender perception by 38 students from the target group. Agent interests, conversational style, etc., were identical and designed to be gender neutral. Also all agent names were gender neutral. Importantly the agents are humanlike. We were not interested in androgynous agents in the form of artifacts, animals or robots (which can all be designed to be genderless or as avoiding gender).

**Fig. 1.** The agents' visual representation: female, androgynous, and male

### 2.1 Method

44 female and 64 male students of age 12-14 participated. Since all were not present at both lessons, the analysis included 37 females and 46 males. The students played the math game and interacted with two different TAs during two separate 45 minute lessons spaced a week apart from each other. In the first lesson all students played with the visually androgynous agent, in the second they were randomly assigned the female or the male agent. A combination of data from questionnaires and computer-generated logs were used. The questionnaire focused on the experience of chatting with the agent and the perception of the agent. It also contained a question about the agent's visual appearance: "[Agent name] looked like" with the scale: Definitely like a girl, A little like a girl, Neither girl nor boy, A little like a boy, Definitely like a boy. For the second session the questionnaire was extended with free format questions. At the top of the page the name and picture of the two agents the student had encountered were placed and below this the following questions: "Who did you prefer to have as your tutee? WHY?" and "Who did you prefer to chat with? WHY?"

## 2.2 Results

**Perception of Visual Androgyny.** Most students perceived the visually androgynous agent as not clearly a boy nor clearly a girl, but as "neither girl nor boy", "a little like a girl" or "a little like a boy". There was no significant difference in the scores for boys ($M = 2,62$, $SD = 1,33$) compared to girls ($M = 3,05$, $SD = 1,36$); $t(84) = 1,50$, $p = 0,14$.

In the chat conversation with their digital tutees, students could potentially ask their tutee about its gender. (Androgynous agents were assigned the same gender as the agent in the second session.) However, the visually androgynous agent was asked about its gender by only 15% of the students. Simultaneously it was obvious from classroom observations and from the free format questionnaire answers, that the students generally themselves assigned a gender to it. In other words, even though a majority of students did not perceive a clear gender – boy or girl – in their androgynous tutee agent, they did not ask her/him about her/his gender – but assigned one, by their own decision.

These results are important. They indicate that perceiving an agent as visually androgynous is compatible with assigning a gender (male or female) to it, but with this assignment being personal rather than imposed by external information.

**Preference of Agent as Tutee.** The analysis of which agent students preferred as their tutee was undertaken for the two conditions androgynous agent vs. female agent, and androgynous agent vs. male agent, and with regard to student gender. The data was coded as follows: 1 stands for a preference for the androgynous agent 0 stands for a preference for the female or male agent, and 0,5 stands for "it does not matter" (or the like). Means were then calculated for the different groups, see Fig. 2.

All groups show a significant preference for the androgynous agent ($M = 0.64$, $SD = 0.46$) over the gendered (female and male) agents; $t(76) = 2.74$, $p = 0.007$). Girls significantly preferred the androgynous agent ($M = 0.78$, $SD = 0.43$) over the female agent; $t(17) = 2.75$, $p = 0.014$. For boys, this preference was marginally significant ($M = 0.68$, $SD = 0.41$; $t(19) = 1.93$, $p = 0.069$). Girls significantly preferred the androgynous agent before the male agent ($M = 0.74$, $SD = 0.44$); $t(16) = 2.22$, $p = 0.041$, whereas for boys ($M = 0.43$, $SD = 0.50$) there was no significant result; $t(21) = -0.65$, $p = 0.53$.

**Preference of Agent as Chat Partner.** Preference for chat partner was coded the same way as that regarding preference of tutee, and the results are shown to the right in Fig. 2. The androgynous agent was preferred ($M=0.67$, $SD=0.43$) over the female and male agents for the group as a whole; $t(67)=2.00$, $p=0.002$. Boys preferred the androgynous over the female agent ($M=0.81$, $SD=0.30$); $t(17)=2,1$, $p=0.0005$, while girls showed no such significant preference $t(16)=2.12$, $p=0.23$. Girls preferred the androgynous ($M=0,82$, $SD=0,37$) before the male agent, $t=2.16$, $p=0.007$, while boys showed no such significant preference, $t(18)=2.10$, $p=0.63$.

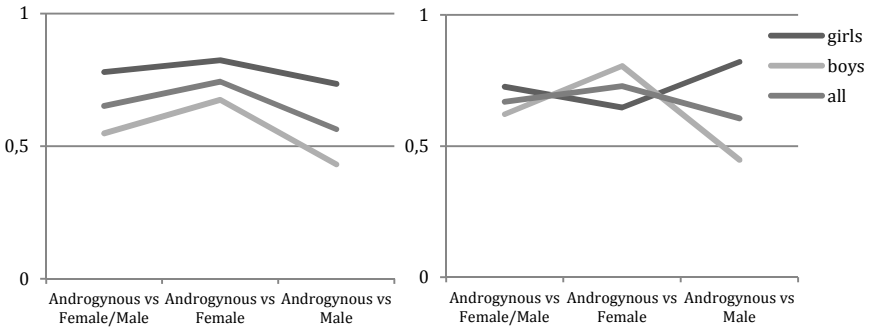


**Fig. 2.** Left: Means for student preference for tutee. Right: Means for student preference of chat partner. 1=androgynous agent, 0=gendered agent (female or male).

## 3 Conclusions

At the outset of the paper we discussed educational benefits as well as drawbacks with clearly gendered pedagogical agents and asked: Can we retain the benefits and avoid or diminish the drawbacks? Can we have the cake and eat it too? On these questions we want to give cautious affirmative answers. Visually androgynous characters can, as indicated in our study, be well received (a primary condition that has to be fulfilled). A main result was that girls consistently preferred the visually androgynous character both before the female character and the male character. Boys preferred an androgynous agent before a female, but preferred an androgynous and male agent equally.

Importantly, visually androgynous agents, as constructed in the present study, combine possibilities for identification on the basis of gender – known to be pedagogically valuable due to role modeling effects – with increased freedom for the students themselves to construct and ascribe gender. Simultaneously one can avoid or diminish the drawback of reproduction of gender stereotypes, since a visually androgynous character does not embody categorical gender.

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