

# Design and Evaluate Embodied Virtual Agent

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#### Research Summary

This research is intended as an effort towards a progressive and inclusive approach for gender representations in virtual agents.

- Researched and identified problem space of AI conversation system through user testing, qualitative and quantitative study and secondary research.
- Ideate and created new design solution for 3D embodied agents
- Validated and iterated design with two quantitative and qualitative study
- Evaluated the research assumption by quantitative research method

#### Virtual Agent

Virtual Agents (VA) are AI agents created for user (human) interaction like:

- Chatbots
- Voice only agents
- Embodied agents
- Embodied conversational agents (ECA) (Cassell et al., 2000)



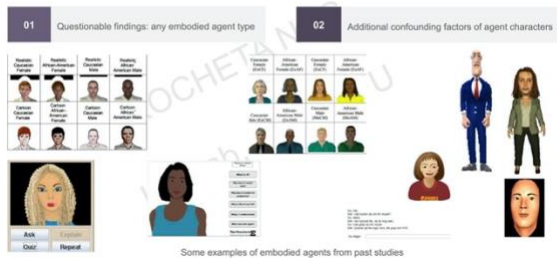
Virtual AI Agent (viziab)

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<https://viziab.org/research/> 1

#### Issues with past studies

(From literature review)



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(From literature review)

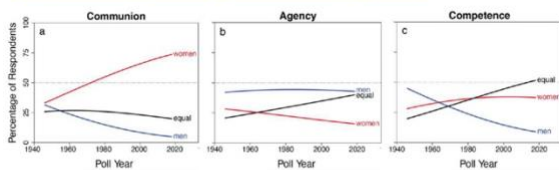


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#### Theory

Gender stereotypes have been found in virtual agent research (Gulz et al., 2008, ...);

However, Gender Stereotypes are Changing for Humans. New study (Eagly et al. 2020).



Social roles of (human) women and men, (Eagly et al., 2020)

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#### Research Questions



##### Question #1

When only varying with binary gender related appearance of embodied virtual agents (ECAs), how does the experience of the user change?



##### Question #2

Moving past binary distinctions of male and female, how does the more fluid notion of gender (or even gender neutral) affect a user's experience with ECAs?



##### Question #3

How does the gender-related appearance of male, female and androgynous agents impact the user perception in terms of gender stereotypes traits?

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#### Research Objectives



##### Objective #1

Examine the effect of gender during a user's conversation with the embodied conversational agent (ECA).



##### Objective #2

Examine the user experience on perceiving realistic 3D ECA characters, where all other factors are kept as uniform as possible, to measure for differences in ECA visual gender cues only.



##### Objective #3

Examine the effect of the agents' gender-related appearance: male, female and androgynous, on user perception in terms of gender stereotype traits and roles.

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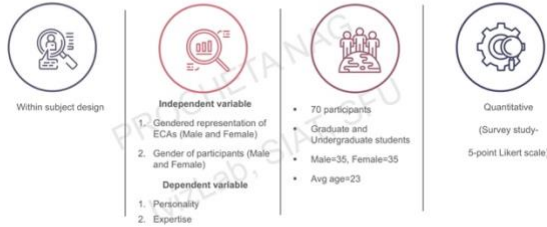
#### STUDY 1 : Effect of Gender on Interaction with Embodied Conversational Agents

Poster presented at Women in Machine Learning Workshop, NeurIPS 2019.

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## Study Design

Study 1 description



## STUDY 1

## Survey

Survey conducted in Survey Monkey - users watched a VA academic counselling session

Scenario 1: Female agent talking with a human person



Scenario 2: Male agent talking with a human person

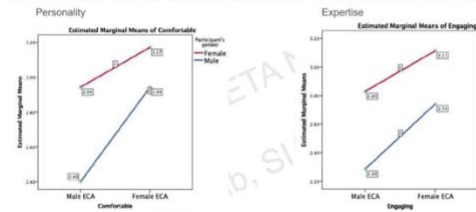


2 minutes video each | Interaction assessment questionnaire

## STUDY 1

## Results

Used Two way 2 (ECAs gender: male or female) \* 2 (participant's gender: male and female) mixed ANOVA with repeated measures



- Significant main effect of comfortable conversation and engaging,  $p < .001$
- Participants rated female conversation as more comfortable and engaging than male regardless of gender.

## STUDY 1

## Discussion

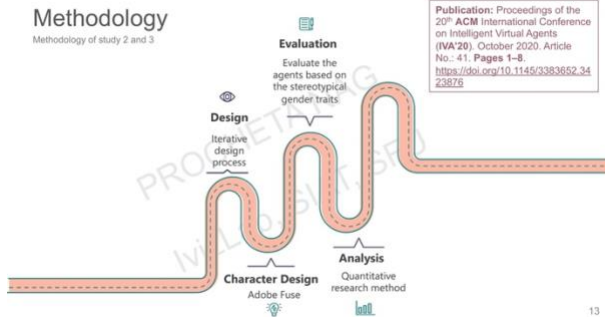
Lessons learned from study 1 applied to study 2 and 3



## STUDY 1

## Methodology

Methodology of study 2 and 3



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## Hypothesis

Combined hypothesis of study 2 and 3

Following the recent findings of Eagly and colleagues (Eagly et al., 2020)...

- Hypothesis 1**  
Communication traits would be rated significantly higher for the agents that are perceived as female, followed by androgynous and male agents.
- Hypothesis 2**  
Agency traits would be rated significantly lower for the agents that are perceived as female, followed by androgynous and male agents.
- Hypothesis 3**  
Competence traits would not be significantly different between agents that are perceived as more female, androgynous and male.

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## Design Rationales

First Iteration of Character Design

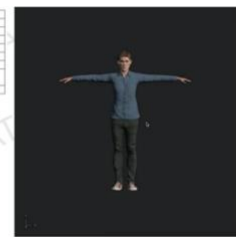
| Properties | M1             | M2           | F1             | F2          | A1    | A2  |
|------------|----------------|--------------|----------------|-------------|-------|-----|
| Features   | average        | companion M1 | child & thick  | F1          | M1    | F1  |
| Eyebrows   | regular        | M1           | fuller thicker | F1          | F1    | M1  |
| Cheek      | high & regular | F1           | round & low    | F1          | F1    | M1  |
| Jaw/Chin   | square & long  | F1           | round & short  | protrude F1 | M1    | F1  |
| Lips       | narrow         | M1           | fuller         | F1          | F1    | M1  |
| Lip color  | red            | M1           | red            | red         | red   | red |
| Neck       | wide & adult's | M1           | narrow         | F1          | wide  | F1  |
| Hair       | short          | M1           | mid-length     | long        | short | A1  |

Table shows details of the attributes that were changed according to the intended gender of the agent.

M1,M2=Male-gendered attributes,

F1,F2=Female....

A1,A2=Androgynous....



## STUDY 2

## Design Character

First Iteration of Character Design

Avoided Clothing, Skin, hair and eye color, Body type and height, Facial expression differences.



Male (M1,M2), Female (F1,F2) and Androgynous (A1,A2) characters design

## STUDY 2

## Design Evaluation

First Iteration of Character Design



## STUDY 2

## Redesigned Male, Female and Androgynous Characters

Second Iteration of Character Design (A...=Androgynous, M...=Male, F...=Female)

Removed overlooked features Adam's apple, wide neck and fuller eyelashes



Design Character

Study

Results

Discussion

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### Study 3 : Evaluate based on stereotypical traits and role

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## Study Procedure

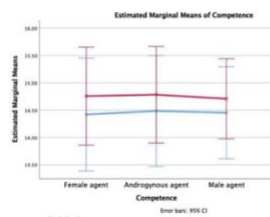
Conducted survey on Amazon Mturk with a link to a survey prepared in the Survey Monkey platform.



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## Results

Agents gender related appearance and its correlation with the stereotype traits score based on participant's gender.

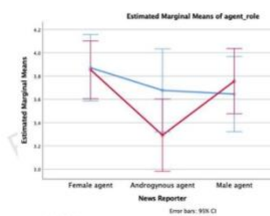


✓ No significant main effect of agent's appearance, participant's gender on competence scores and interaction between agent's appearance and participant's gender,  $p > .05$  (H3 holds)

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## Results

Agents gender related appearance and its correlation with the stereotype role score based on participant's gender.



✓ Significant main effect of agents' appearance on news reporter role scores,  $p < .05$

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## Design Evaluation

Second Iteration of Character Design

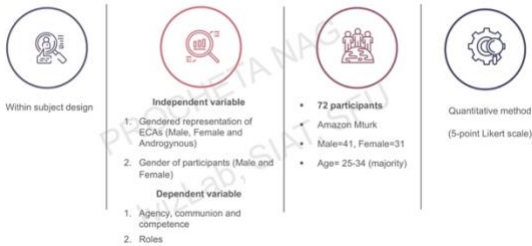


STUDY 2

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## Study Design

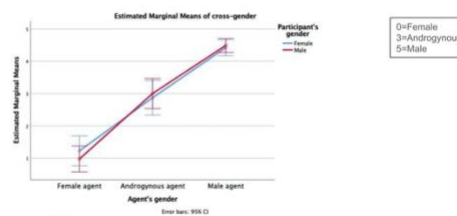
Study 3 design



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## Results

Agents gender related appearance and its correlation with the gender score based on participant's gender.

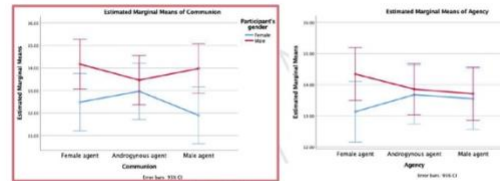


✓ Significant main effect of agents' appearance on identifying the agent's gender,  $p < .001$ .

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## Results

Agents gender related appearance and its correlation with the stereotype traits score based on participant's gender.



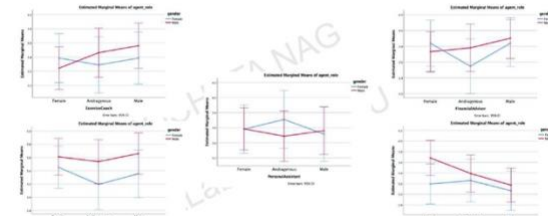
Significant interaction between agents' gender and gender of the participants for communion scores,  $p < .05$

No significant main effect of agents' appearance, participant's gender on agency and communion scores,  $p > .05$  (H1 and H2 rejects)

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## Results

Evaluated the gendered appearance of agents based on stereotype roles



Agents gender related appearance and its correlation with the gender score based on participant's gender.

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## Discussion

Findings of study 3

### Discussion #1

Representative of male, female and androgynous agents with minimal differences.

### Discussion #2

Androgynous agents could be used to achieve a middle ground of the male and female gender.

### Discussion #3

Gender-balanced view of agency, communion, competence traits.

### Discussion #4

Roles could be used interchangeably, even with androgynous agents

## STUDY 3

## Contribution

Contribution to the research area

Rigorous design process to create visual design balance

Minimize confounding features

Introducing androgyny

Changing gender stereotypes notion reflects on virtual agent

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## Limitations

- 1 Non interactive scenario in study 2 and 3
- 2 Interviewing study participants might open-up some new findings in study 2
- 3 Lacks balance over participants race and age in studies
- 4 Other approaches could be considered to create gender neutral character

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