



# Human Perception of Gendered Artificial Entities



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## The CASA Debate

### What's CASA?

CASA (computers as social actors) theory states that **humans treat machines like other humans**. This effect has been verified in multiple human-robot interaction studies (2, 7, 9, 10).

### Does voice gender affect human perception?

**YES:** An evaluation of voice gender in human-robot interaction (HRI) research concluded that **"choosing a computer voice's gender is one of the most important design decisions** that can be made" (7, p. 154).

**NO:** After conducting a sex survey by way of CASI (computer-assisted self-interviewing) technology, several investigators boldly stated, **"the gender of the voice is unimportant"** (13, p. 466).

## Research Objectives

1. Does the CASA effect exist?

2. If so, does the effect become more pronounced if...  
...the situation is more interactive?  
...we increase the entity's level of physical embodiment?

3. Does human perception change with entity gender?

## Approach

### What's unique?

Because few investigations have focused on task-specific HRI, the objective of the present study is to determine if more specific judgments about entity personality and capability are made on the basis of a perceived gender through a voice cue during a task-oriented scenario. The analysis is also considered unique to this study (see results).

### Equipment

I developed a task-specific artificial intelligence engine exclusively for the project. In addition, I created several Java, Python, and RoboBasic programs to connect the engine with a computer terminal and a Robonova robot.



Fig. 1: Robonova robot, "Jayden".

### How it works

In the study, male and female subjects interacted with a male- or female-voiced computer or the robot. The interaction includes a Marlowe-Crowne survey (a standard assessment of social desirability) and a cooperative task between the subject and the machine. Their reactions to the entity in each situation were recorded to determine if physical embodiment or voice gender induce the CASA effect.

## Results

### Analysis includes Spearman coefficient matrices and median response

This experimental procedure was virtually identical to one performed and published in 2009 (Crowell et al.), wherein ANOVA and ANCOVA tests were used to conclude that the CASA effect exists. However, because our data do not represent a normal distribution, we could not logically use ANOVA or ANCOVA (or many other statistical) tests. Instead, we examined the medians (to some extent) and Spearman coefficient matrices, which may be used with skewed distributions.

### Entity gender and embodiment do not appear to affect median response

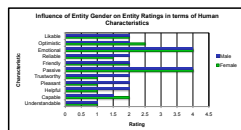
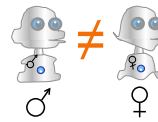


Fig. 2: Subjects rated how well the entity corresponded to human characteristics. The blue bars indicate ratings of a male entity; the green, a female entity.

Figure 2 shows the medians of the degree to which students applied humanoid characteristics to the entity. The results suggest the subjects do not mind applying characteristics to the entity. However, note that the gender of the entity does not significantly affect responses. In terms of the median rating, embodiment similarly did not appear to influence subject response.

### Entity gender and embodiment significantly affects response correlations

Tables 1 and 2 display a number of significant Spearman correlation ranks for ratings the entity received when it was (1) gendered male or female and (2) embodied as a terminal or a robot. There were significant differences in each of these pairings that may be interpreted as results of social constructs.



## Results (cont.)

Correlated Ratings	Male Entity	Female Entity	Significant Conditions
Reliable/Emotional	0.1870	-0.4065	Female
Understandability/Passive	0.2390	-0.5580	Female
Reliable/Likable	0.5127	-0.1089	Male
Passive/Likable	-0.6337	-0.1615	Male
Capable/Passive	-0.0837	-0.5378	Female
Understandable/Pleasant	0.7355	0.7282	Female, Male

Table 1: Correlations between ratings the entity received when it was gendered male or female. The data suggest that the gender of the entity affects how the subject deems the characteristics of the entity with respect to each other (> 0.4 significance; > 0.6 high significance).

Correlated Ratings	Terminal	Robot	Significant Condition
Understandable/Capable	0.7222	0.0000	Terminal
Pleasant/Reliable	0.6902	0.1900	Terminal
Understandable/Pleasant	0.6441	0.8413	Terminal, Robot
Understandability/Trustworthy	0.6172	0.3183	Terminal
Helpful/Reliable	0.7127	0.3651	Terminal
Friendly/Optimistic	0.5342	0.7305	Terminal, Robot

Table 2: Correlations between ratings the entity received when it was physically embodied as either a terminal or a robot. The data suggest that the degree of the entity's embodiment influences how the subjects deem the characteristics of the entity with respect to each other (> 0.4 significance; > 0.6 high significance).

## Discussion

### Results point towards confounding variables

Computational neuroscience is a rapidly expanding field, and it is expected that true humanoid robots will soon become available for manufacture. If we are truly entering an age where robotic intelligence is no longer merely a product of fiction, we must carefully consider how humans will perceive robots and how we wish to represent them to provide society with the greatest benefit.

The fact that statistical, interpretable significance associated with voice gender exists suggest that **gender is an important feature in robot design**. However, the presence of conflicting data indicates that there are unconsidered confounding variables that, at the moment, limit our understanding.

Future research must isolate these variables and construct a detailed map of how the gender of an entity influences perception. Only when these variables are identified will we have a solid grasp of how we view artificial entities, social constructs, and ourselves.

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