

# Bon Appetit! Robot Persuasion for Food Recommendation

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## ABSTRACT

The integration of social robots within service industries requires social robots to be persuasive. We conducted a vignette experiment to investigate the persuasiveness of a human, robot, and an information kiosk when offering consumers a restaurant recommendation. We found that embodiment type significantly affects the persuasiveness of the agent, but only when using a specific recommendation sentence. These preliminary results suggest that human-like features of an agent may serve to boost persuasion in recommendation systems. However, the extent of the effect is determined by the nature of the given recommendation.

## CCS CONCEPTS

• **Human-centered computing** → *Interaction design process and methods*; • **Computer systems organization** → **Robotics**;

## KEYWORDS

Robotics, Embodiment, Recommendation system, Persuasion

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## 1 INTRODUCTION

Giving consumers personalised recommendations is an integral part of service industries such as tourism, retail, and hospitality. It is likely that the integration of social robots within these industries will require these robots to support recommendation systems.

Recommendation systems help users orient large amounts of information and can facilitate the influencing of consumer decisions through persuasive strategies [2]. Persuasion is the attempt to change an individual's attitudes or behaviours without using coercion or deception [3]. There is evidence to suggest that persuasive recommendation systems can impact consumer decisions [2].

Human-Robot Interaction literature also illustrates a persuasion effect with social robots. A humanoid robot has been found to be as persuasive as a real human or a video recording of a real human when persuading individuals to make a consumer decision [6]. Additionally, persuasiveness has been demonstrated in robots equipped with social persuasion strategies such as gaze behaviours [4]. Together, these results suggest that the more a robot's behaviour is social and human-like, the more persuasive the robot may be.

Here we investigate the effect of robot persuasion on decision-making when compared against the persuasiveness of non-social machines and humans. We framed our study in the context of a food recommendation system. We suggest that: (H1) persuasion is dependent on the framing of the agent's embodiment; in particular, (H2) a human is more persuasive than a robot and a robot is more persuasive than an information kiosk.

## 2 METHOD

We developed an online survey to platform our vignette experiment. The survey was distributed through Amazon Mechanical Turk and participants were reimbursed for their time. 212 participants took part in our survey. 20 were omitted for either failing an attention test or fitting our exclusion criteria for inconsistent responses. Thus, 192 participants remain ( $M_{age} = 29.44$ ; male = 101).

We used two independent variables: agent's embodiment and recommendation sentence. The agent's embodiment included three conditions: Human, Humanoid Robot and Information Kiosk. The

recommendation sentence included two conditions: “The atmosphere of this restaurant is really vibrant” (Atmosphere) and “The staff there are very friendly and attentive” (Staff). These recommendations were selected as they ranked highly on persuasiveness in a pilot survey that compared a set of restaurant recommendations.

Participants were randomly assigned to one of the six (3 x 2) conditions. They were presented with a vignette outlining the following scenario: “It is your friend’s birthday and you decide to use a new food recommendation service to book a dinner for him and his partner as a gift. This service is provided by a [embodiment condition]. Based on the preferences of your friend and his partner, you are presented with two options. One of them is also highly recommended by the [embodiment condition] as [recommendation condition]. The average ratings of the restaurants collected from internet are given”. A cartoon icon representing the agent’s embodiment was presented next to the story to frame the embodiment condition.

After reading the vignette, participants were asked to pick between the two restaurant options. A pilot survey was used to determine a star rating comparison, with the current study using a restaurant with a 4 out of 5 star rating and another with a 3 out of 5 star rating *plus* a highly positive recommendation as previously mentioned. Participants then answered a source credibility questionnaire [5]. This 18-item questionnaire assesses users’ impressions of competence, goodwill, and trustworthiness of the agent.

To sum, we assessed the influence of embodiment type on whether a user can be persuaded to choose the lower-ranked restaurant and whether the recommendation given plays an additional role.

### 3 RESULTS

Data analysis was conducted using Minitab<sup>1</sup>. The number of subjects persuaded in the “Atmosphere” condition were: 20/32 (62.5%) for Human condition, 9/31 (29%) for Robot condition, and 13/33 (39.4%) for Kiosk condition. The difference among embodiment conditions was significant, Pearson’s  $\chi^2(2, N = 96) = 7.555, p = .023$ . Thus, we conducted pairwise proportions z-test analyses among conditions. Human condition was significantly more persuasive than Robot condition ( $p = .005$ ), but no significant differences were found between Human and Kiosk condition ( $p = .055$ ) and Kiosk and Robot condition ( $p = .379$ ). The number of subjects persuaded in the “Staff” condition were: 14/31 (45.1%) for Human condition, 11/30 (36.7%) for Robot condition and 15/33 (45.5%) for Kiosk condition. This time, the difference among embodiment conditions was not significant, Pearson’s  $\chi^2(2, N = 94) = 0.625, p = .732$ .

There was a main effect of Embodiment on Source Credibility (MANOVA Wilks’  $p = .034$ ). A follow-up univariate ANOVA uncovered this effect within the Goodwill dimension ( $p = .031$ ). Pairwise t-test provided evidence to suggest a main effect between Human and Kiosk for Goodwill ( $p = .006$ ). Furthermore, the main effect between Human and Kiosk for Goodwill is only seen in the Atmosphere condition ( $p = .048$ ) and not the Staff condition ( $p = .055$ ).

### 4 DISCUSSION AND IMPLICATIONS

The persuasiveness of a recommendation system is dependent on the embodiment of the agent, but only for particular recommendations. Specifically, the human was more persuasive than the robot

and was perceived as more credible than the kiosk due to goodwill, but only when presenting the “Atmosphere” recommendation. Contrary to our prediction, the robot was no more persuasive than the kiosk in both the “Atmosphere” and “Staff” conditions. Hence, these findings partially validate our first hypothesis (H1) and do not provide enough evidence to validate our second hypothesis (H2).

Finding an effect only in the “Atmosphere” condition was unexpected as both recommendations were highly ranked on persuasiveness in our pilot survey. Thus, we believe this effect is unlikely due to a difference in the persuasiveness of the recommendations. Rather, we suggest that this difference may have arose due to the human-centric contents of the “Atmosphere” recommendation compared to “Staff” one. Put simply, to understand “Atmosphere” is to understand subtle emotions and feelings. This is a normal and expected ability of humans, but may be viewed as an odd or impossible feature for a machine to have. If true, this may have limited the perceived credibility of the robot, restricting its persuasiveness in comparison to a human attendant.

This is a speculative conclusion and should be further investigate in future experiments. Vignettes should be presented alongside images and videos of the real world agents for reference to emphasise the distinction between each agent. Further, a potential driving factor of our results may be due to the context of the given scenario. The recommendation of a restaurant may be viewed as abstract and unrelated to a robot which has no real concept of eating or food. As such, vignettes detailing scenarios which allow the robot to be perceived as more of an involved agent, such as the recommendation of technology [6], should be considered. Finally, a controlled experiment that facilitates face-to-face interaction between participants and agents (including a humanoid robot) should be implemented to improve ecological validity. Here, the influence of embodiment can be assessed alongside physical presence- a factor that has previously been demonstrated to affect Human-Robot Interaction [1].

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<sup>1</sup><http://www.minitab.com>