# Facial hair and trustworthiness in virtual faces: Towards an evaluation study

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**Abstract**

*In this paper, we present a work-in-progress towards a perceptual study concerning male and female first impressions of male virtual faces as variations are made in terms of their facial hair (beard) length, colour and the camera viewing angle. Previous studies involving real human faces suggest that these types of variations may impact impressions of trustworthiness and related qualities, such as credibility. This research investigates similar issues, but in the domain of virtual characters, with a view to exploring issues of trustworthiness based on the appearance of virtual faces. This is of great significance to the design of interactive computational social systems.*

## 1. Introduction

Trust plays a pivotal role in shaping human social interactions. Previous studies involving human faces have shown that impressions of trustworthiness, and related factors such as credibility, may vary based on the appearance of individuals, such their facial characteristics [TBO08] and the angle from which the face is viewed [SÏ0]. Such studies are important, not only for informing us about the way in which humans perceive their counterparts, but also for the construction of appealing interactive artificial humanoid systems, such as virtual characters and social robots [McD12]. Yet, while previous research in domains related to computer graphics and animation has focussed on rendering and animating hair, far less has considered its impact on human judgements of virtual faces, an issue of great significance to the design of interactive computational social systems.

This paper presents an overview of a preliminary perceptual study investigating the effects of facial hair and camera angle on human first impressions of trustworthiness, credibility and dominance in male virtual faces. Specifically, beard length, beard colour and camera angle are varied during the course of the study, which involves short 500ms displays of computer generated male faces. The results of the study will guide our future efforts focussing on the automatic generation, rendering and animation of facial hair capable of invoking or accounting for specific social impressions in viewers, especially in relation to trust.

## 2. Background

Previous research has considered trust and related concepts in both human and virtual faces. In studies involving human faces, facial characteristics such as the shape and place of the eyebrows, cheekbones, chin and nose can affect impressions of trustworthiness [TBO08]. In studies related to politics, election outcomes have been linked to candidates' perceived trustworthiness and attractiveness [LRJD12]. Studies of trustworthiness relating to facial hair and gender have led to mixed results. For example, [SP10] reports that bearded faces are less likely to be perceived as trustworthy due to relationships with facial width, while other studies [Bak14] have highlighted increased impressions of trustworthiness for bearded male faces in comparison to those without beards. A further factor that may be related to trustworthiness is camera angle. For example, in a study examining the effects of camera angle on face perception, Sätelli [SÏ0] concluded that the general impression, attractiveness and the credibility of a person is altered by the vertical camera angle used. Research related to trust has also been conducted with virtual characters. Rapport agents [GWG*07], for example, engage in behavioural mimicry and backchanneling feedback in order to attempt to develop trust, liking and influence with human participants. While these studies focus on behavioural aspects, far fewer have considered the impact of appearance, and especially, varying facial hair and camera angle on impressions of trustworthiness.

## 3. Preliminary Study

In a preliminary study, a male face model from Facegen (http://www.facegen.com/) was used as a basis for a number of different experiment conditions. These included beard length variations: no beard, stubble, medium beard; colour variations: dark brown, grey; and vertical camera angles: level, high, low angle (see Figure 1).



**Figure 1:** *Examples of stimuli used in the perceptual evaluation study. The subimages illustrate some of the conditions for beard length (top row), and beard colour and camera angle (bottom row).*

The study involved 11 participants (6M:5F), aged between 21 and 29, in a within subjects design. All were students at KTH Royal Institute of Technology. Images for each of the conditions (5 trials per condition, counterbalanced) were shown to participants for a short duration (500 ms each) to probe their first impressions [WT06]. After each image, a blank screen was displayed and participants rated the trustworthiness, credibility and dominance respectively of the preceding face by selecting an option from a five point Likert scale on a written questionnaire.

## 4. Discussion and Future Aims

The findings of the pilot study generally suggest that alterations of the beard length, colour and the camera angle affected the perception of the virtual face. Generally, as the length of the beard increased, the virtual face was rated as more dominant but less trustworthy and credible, a result that coincides with findings in [SP10], but is at odds with the finding in [Bak14], which involved human faces. Faces displayed at low camera angles were perceived to be the least trustworthy and credible, matching findings with human faces reported in [SÏ0]. They were also rated to be the most dominant. We intend to use this study in order to guide the design of a statistically significant user study involving a large participant population in order to compare our results with outcomes of studies involving human faces (see Section 2). There are many possibilities for future work, including accounting for the gender and culture of participants,

in addition to attractiveness, rendering style, face shape and masculinity [SP10]. In relation to gender, for example, previous studies such as [NS08] found that females rated short beards (stubble) as the most attractive option in a selection of beard types, while bearded males were rated as more masculine and aggressive than counterparts without beards. A broader aim of future perceptual studies is to inform real-time facial hair generation techniques, such as layered textured polygonal patches [Sch04], in order to allow a user to specify character appearance through high-level social perception control parameters, such as trustworthiness.

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