When humans become objects

Out-group effects in real and artificial faces

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***Abstract*— Out-group members are commonly viewed as being less human than in-group members. They are denied certain human characteristics and in turn become associated with machines or automata. Specifically, out-groups are attributed less naturally and uniquely human traits, and they are also seen as being less able to experience complex emotions in comparison to the in-group. Such dissociations have been demonstrated with real human faces but in our study, we aimed to test whether similar effects generalize to their artificial versions. Caucasian participants were presented with images of male Caucasian and Indian faces. Their task was to evaluate to what extent naturally and uniquely human traits, as well as primary and secondary emotions, can be attributed to them. In line with previous research, it was found that positive naturally human traits were attributed to a greater degree to the in-group than to the out-group, applying to both real and artificial faces. Moreover, negative naturally human traits and negative primary emotions were attributed more to the out-group. This indicates a positive bias towards the in-group and subtle out-group derogation. The results extend prior research based on real human faces and show that intergroup processes emerge similarly in response to artificial faces, which may have implications for the fields of computer graphics and animation. That is, even the most realistic face recognized as belonging to an out-group member may convey less humanness than that of an in-group member.**

Keywords— objectification; dehumanization; realism; emotion; out-group

I. INTRODUCTION

People's reactions to computers are inherently social [1]. Hence it is logical to assume that one way of aiding human-computer interactions (HCI) is to increase humanness of the interfaces, which should render them more natural and understandable [2]. This may be achieved, for instance, by incorporating an agent with a human face [3]. First attempts to synthesize a highly authentic face began over 40 years ago [4]. To this day, creation of flawless photorealistic faces remains the "ultimate challenge" of computer graphics and animation [5, 6, 7], primarily oriented towards contributions to the areas of entertainment and virtual reality [8]. On the other hand, Mori [9, 10] warned against the efforts to attain a very human-like appearance in design. He predicted that when characters approach extreme levels of human likeness, they might suddenly lose credibility and evoke feelings of uneasiness, a phenomenon referred to as the Uncanny Valley [9].

Faces are regarded as an exceptionally important [11], or even special [12, 13], type of a stimulus, which engages brain areas thought to be specialized in its processing [14]. Lately, a lot of research has been devoted to how synthetic faces are perceived, but the results have been rather mixed. Some studies, for example those relying on functional magnetic resonance imaging (fMRI) and event-related brain potentials (ERP), found that artificial faces seem to be processed differently than real faces [15, 16]. A similar conclusion was reached in a few studies exploring the recognition of emotions [17, 18]. However, findings to the contrary abound, suggesting that various kinds of artificial faces, as well as face-like objects, elicit responses and allow emotion detection rates close to those of real faces [19, 20, 21, 22, 23, 24]. Furthermore, although faces attract attention faster than other items [25] and as visual cues are favored over other types of input [26], this is also true for schematic face-like stimuli [27]. Finally, computer-generated faces are often used in research on group categorization and prejudice the results of which map onto those employing real faces [28, 29, 30]. Consequently, their usage is considered to be advantageous because their external features or expressions can be easily manipulated and controlled, unlike in the case of real faces. Nonetheless, one apparent drawback of all of these studies is that the artificial faces represented the African-American minority associated with very specific stereotypes, for instance being aggressive [31].

Independently of questions concerning how the realism of facial stimuli influences purely perceptual processes, faces are an extraordinarily functional social stimulus. They carry a multitude of information and meaning, and serve as a cue for instant evaluations of others on distinct attributes. The essentials include gender, age, and ethnicity [32], and many other characteristics as well, such as attractiveness, likeability, and trustworthiness [33], or competence [34]. Moreover, faces are typically the first source of information pertaining to group membership. Categorization of people as belonging to either one's in-group or out-group is common and in fact unavoidable in real-life social encounters [35]. In general, the in-group is the foundation for positive identity and so it is favored over out-groups [36, 37, 38]. Out-group members are frequently targets of prejudice [39, 40].

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One of the manifestations of out-group prejudice, and its worst case, is the failure to perceive out-group members as complete human beings [41]. Thereby, they are not granted a full range of human qualities, comprising personality traits [42], complex emotions that are a marker of sophistication [43], and mental states [44]. Denial of traits that have been previously identified as natural or essential to all human beings (naturally human traits, e.g., warmth, depth) reduces people to objects, machines or automata [45]. This phenomenon has been thus termed mechanistic dehumanization and was theorized to have implications particularly in the domain of computer technology [45]. In a different line of research, equation of humans with objects is referred to as objectification [46]. It is associated with perceived lack of mind and what follows, compromised capacities that are distinctive for humans [47], especially the ability to experience refined emotions (secondary emotions, e.g., elevation, envy, but not basic, or primary, emotions, e.g., happiness, anger; [43]).

Differential attribution of human characteristics to in-groups and out-groups has been demonstrated by numerous studies in which social groups were represented descriptively [42, 48, 49, 50]. Only a few studies so far relied on visual, and here specifically facial, stimuli [51, 52, 53]. These were always the faces of living humans and it has been found that faces of out-group members appear overall less human. This intergroup phenomenon has not been investigated yet in the context of artificial faces. Avatar-like faces have been used before to show intergroup prejudice, mainly towards African-Americans, as well as decreased empathic responding to this racial group [54]. Nevertheless, group membership of the computer-generated characters has not been considered to play a role in how human-like they seem to the viewers. In our paper, we argue that group categorization is an important psychological factor engaged in reactions to synthetic characters. Therefore, just as real faces in daily interactions, even highly human-like synthetic faces may be perceived as representing diminished humanness when they convey group membership other than one's own.

Based on previous work outlined above, two main hypotheses were developed. First, we predicted that out-group faces would have human qualities attributed to them to a lesser degree. Second, this out-group effect would be similar for real and artificial faces. In an attempt to go beyond the widely studied racial categories (i.e., Afro-Americans) into the area of unknown out-groups or groups that elicit ambiguous attitudes, we presented members of a homogenously Caucasian society (Polish) with real and artificial faces of Indians. This was thought to be an out-group with which Polish participants were likely not to have had much direct interaction and which clearly differed in regard to looks, but was not paired with uniformly negative stereotypes. The study was conducted on-line. Realism was treated as a between-subjects factor, ensuring that artificial faces were not instantly assumed to represent their real counterparts. Participants' task was to evaluate the degree to which naturally and uniquely human traits as well as uniquely and non-uniquely human emotions could be attributed to the faces. The artificial faces were of high level of human likeness, but evidently differed from the real faces considering their perceived aliveness (see [55]).

II. EXPERIMENT

A. Participants

The on-line survey was accessed by 190 people and completed by 82. All non-Caucasian and underage individuals, as well as those who indicated they only wanted to browse the pages of the questionnaire, were excluded before any further analyses. The final sample consisted of 58 self-declared Caucasian participants (20 men), ranging in age from 18 to 65 years (M = 25.72, SD = 10.01). Most of them (69%) indicated the USA to be their country of origin. The survey was in English and the link to it was distributed via universities-based web pages and forums.

B. Materials

Photographs of eight neutral faces of adult, Caucasian and Indian males (four of each) comprised the facial stimuli in this experiment. They were acquired from the Center for Vital Longevity Face Database [56]. The photographs were used as a basis for creating the faces' artificial-looking counterparts by applying a number of modifications in Photoshop (CS3-ME, Adobe Systems Inc., 2007).

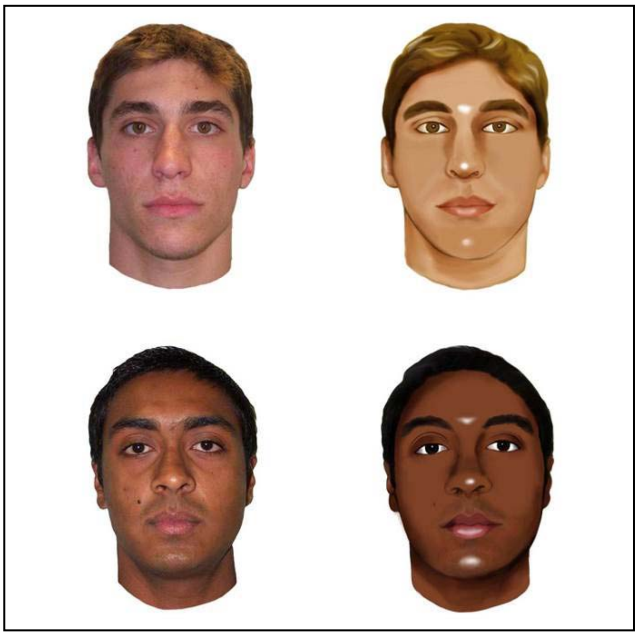

Fig. 1. Examples of real (left) and artificial (right) Caucasian and Indian faces.

Facial morphology was not changed in order to preserve the faces' identity. The altered faces (four Caucasian, four Indian) composed the set of artificial versions of the stimuli. To ensure that artificial faces differed significantly in perceived aliveness from real faces, ratings were obtained from an independent sample of 60 participants. Results confirmed that the artificial versions were judged as being significantly less alive (M = 1.52) than the realistic ones (M = 6.15, $p < 0.001$, scale 1-7). In total, the stimulus set added up to 16 pictures (8 real faces, 8 artificial faces). They measured 532 x 407 pixels and were displayed on a white background. Examples of stimuli are shown in Fig. 1.

C. Procedure and Design

Participants took part in the study individually in their own time. They were randomly directed to view either real faces or their artificial analogues. The experimental task consisted of evaluating the degree to which a given characteristic (human traits and emotions) could be ascribed to a face. Human traits were selected based on dehumanization research by Haslam and colleagues [45, 57] and included four uniquely human traits (*positive*: organized, broadminded; *negative*: rude, shallow) and four naturally human traits (*positive*: friendly, trusting; *negative*: shy, impatient). Emotion terms were drawn mainly from research by Demoulin et al. [58] and comprised four primary emotions (*positive*: pleased, calm; *negative*: fearful, angry) and four secondary emotions (*positive*: sympathetic, hopeful; *negative*: ashamed, guilty). As both positive and negative characteristics were used, valence was treated as an additional factor in the analyses of results.

Participants were instructed to focus on one face at a time and indicate their first impressions. Every page of the survey displayed one picture on the top and eight characteristics underneath. As each face was to be evaluated on 16 characteristics overall, all of the faces were presented twice. Faces as well as the characteristics appeared in random order and responses were marked on a 7-point Likert scale (ranging from *1 – not at all*, to *7 – very much*). The survey was delivered using EFS Survey, a web-based software (Version 9.0, QuestBack AG, Germany).

III. RESULTS

A multivariate analysis of variance (MANOVA) with Realism of the faces (real, artificial) as a between-subjects factor and Ethnicity of the faces (Caucasian, Indian) as well as Valence of the traits (positive, negative) as within-subjects factors was conducted on four dependent variables (uniquely and naturally human traits, primary and secondary emotions). For all univariate analyses, the Greenhouse-Geisser adjustment to degrees of freedom was applied. The multivariate main effects were significant for Ethnicity, $F(4, 53) = 3.21$, $p = 0.02$, $\eta_p^2 = 0.20$, and Valence, $F(4, 53) = 11.83$, $p < 0.001$, $\eta_p^2 = 0.47$. These two main effects were qualified by a significant multivariate interaction between Ethnicity and Valence, $F(4, 53) = 7.59$, $p < 0.001$, $\eta_p^2 = 0.36$.

In terms of univariate tests, the interaction was significant for uniquely human traits, $F(1, 0.53) = 6.60$, $p = 0.013$, $\eta_p^2 = 0.12$, naturally human traits, $F(1, 0.29) = 14.97$, $p < 0.001$, $\eta_p^2 = 0.21$, and primary emotions, $F(1, 0.43) = 5.03$, $p = 0.029$, $\eta_p^2 = 0.08$. Analyses of simple effects showed that participants rated Caucasian faces higher on positive naturally human traits in comparison to Indian faces ($M = 3.62$ vs. $M = 3.38$). Other differences concerned exclusively negative characteristics. Here, Indian faces scored higher than Caucasian faces on negative naturally human traits ($M = 3.83$ vs. $M = 3.52$) as well as on primary emotions ($M = 3.44$ vs. $M = 3.18$). Interestingly, Caucasians were rated higher than Indians on negative uniquely human traits ($M = 3.85$ vs. $M = 3.36$). No significant differences occurred for either positive or negative secondary emotions ($p > 0.05$). All mean ratings of Caucasian and Indian faces on the characteristics can be seen in Table I.

TABLE I. MEAN RATINGS OF CAUCASIAN AND INDIAN FACES ON HUMAN TRAITS AND EMOTIONS

Variable	Caucasian		Indian	
	M	**SE**	***M***	**SE**
Positive				
Uniquely Human Traits	3.45	0.12	3.45	0.13
Naturally Human Traits	3.62$_a$	0.10	3.38$_a$	0.12
Primary Emotions	3.85	0.12	3.73	0.13
Secondary Emotions	3.40	0.11	3.34	0.12
Negative				
Uniquely Human Traits	3.85$_a$	0.13	3.36$_a$	0.14
Naturally Human Traits	3.52$_a$	0.10	3.83$_a$	0.12
Primary Emotions	3.18$_a$	0.11	3.44$_a$	0.13
Secondary Emotions	3.22	0.11	3.26	0.12

Means within rows sharing a common subscript differ at $p < 0.05$.

No significant main effect emerged for Realism $F(4, 53) = 0.71$, $p = 0.587$, $\eta_p^2 = 0.05$, suggesting similar responses to real and artificial faces. As can be seen in Fig. 2 ratings were highly comparable across the real and artificial versions of the faces.

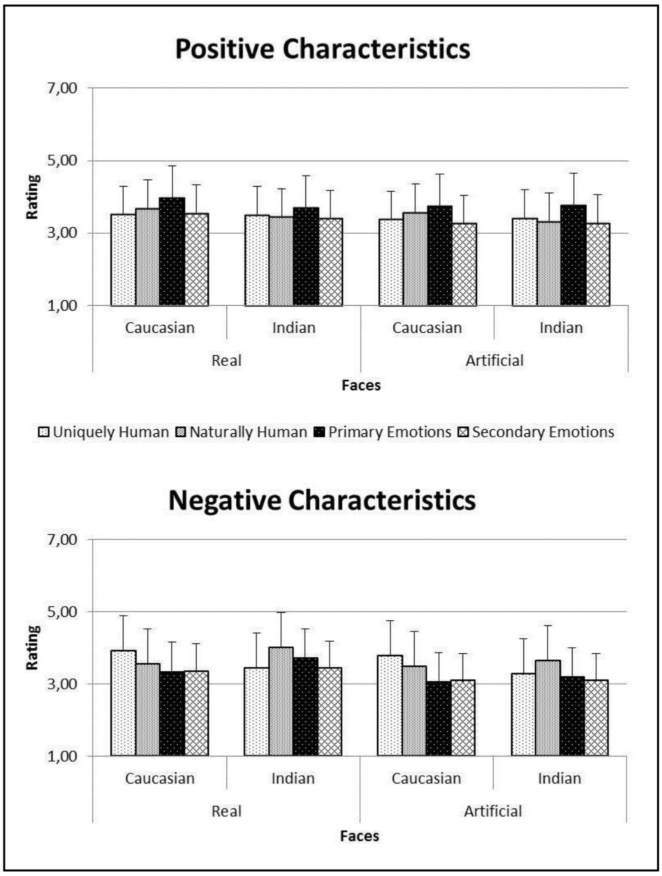

Fig. 2. Mean ratings on positive and negative characteristics for Caucasian and Indian faces. There were no significant differences between ratings for real and artificial versions of the stimuli.

IV. DISCUSSION

Out-group members are often perceived as being less human than in-group members. They are denied a range of specific qualities, including traits classified as naturally human, that is, traits linked to interpersonal warmth, openness, emotional responsiveness, agency, and depth [45], and emotions unique to humans, or secondary emotions [43]. As a consequence, they become associated with machines or automata. The purpose of the current study was to extend earlier research that demonstrated such effects for real faces of out-group members by investigating how people would respond to artificial faces. In accord with previous findings, the results showed that positive naturally human traits were attributed to a greater degree to in-group faces in comparison to out-group faces. Furthermore, negative naturally human traits and negative primary emotions were attributed more to the out-group. All of these generalized to the artificial versions of the faces. This indicates that artificial facial stimuli elicited intergroup processes that are comparable with reactions to real faces. The faces represented an ethnic out-group that was unfamiliar to the participants and not associated with specific stereotypes.

Greater attribution of positive naturally human traits to the in-group manifests the well-established phenomenon of in-group favoritism and appears to be consistent with predictions regarding increased association of the out-group with objects. Lack of certain features that are natural or essential to all human beings makes out-group members seem cold, rigid, and passive, and thus machine-like [45, 57]. Slight out-group derogation may be inferred from the way negative naturally human traits and negative primary emotions were attributed to the faces. Unexpectedly, negative uniquely human traits were associated more with the in-group. Greater attribution of negative uniquely human traits to the in-group is counterintuitive, and contrary to previous findings. However, this group of traits, as well as how they are assigned to in-groups and out-groups, typically has not been related to the field of computer technology. As uniquely human features, including secondary emotions, principally help distinguish humans from animals [45], they might have been extraneous in the present framework of human-computer interaction. This is also reflected by the finding that no difference occurred in how secondary emotions were attributed to in-group and out-group faces.

These findings suggest that the perception of how much humanness a face conveys may not be determined by its realism, but rather by what it represents as a higher-order construct; specifically, a construct that carries important social meaning. Given the most recent advances in the area of computer graphics, the final goal has rested mainly in the perfection of synthetic faces' realism, and thereby generation of photorealistic faces that will eventually be impossible to distinguish from living humans [5]. In that context, minor deficiencies in appearance may render the face unnatural, potentially falling into the Uncanny Valley and evoking eeriness on the part of the viewers [9, 59]. As a consequence, researchers have focused on examining which features of faces are problematic by scrutinizing single facial elements at a time, for instance the eyes [55, 59, 60], instead of considering a face to be a whole that is a salient social stimulus, rich in information which the viewer draws on to shape the interaction.

People readily go beyond what they are able to observe directly and continually make inferences about the unobservable states and characteristics of their interactants. One of the critical social functions of faces is that they symbolize humanness, embedded in a variety of human qualities and in possession of mind that is a prerequisite for mental connection, strongly desired by humans [61]. Nevertheless, people have been shown not to connect with everybody in exactly the same way. Group membership, among other factors, plays a crucial role with respect to whether and to what extent such connection is attainable. Even if out-group members look as realistically as in-group members, they may still be regarded as not fully human and further, as inadequate candidates for mental synchrony. This in turn may have vast implications for the design of computer-generated characters. Out-group here might refer not only to ethnic features, but age, gender, or aspects of clothing that might be perceived by the user in a particular way as being alike or different. Given the heterogeneity of users, this may call for further attempts to customize agents' human features in an attempt to optimize the interaction between user and agent.

In our study, still images of real and artificial humans were used. As movement and animation, as well as sound, have been found to contribute to the effect of the Uncanny Valley [5], an interesting avenue for future research would be to use real and artificial faces that are moving and calling for contingent interaction, or that otherwise allow the viewer to engage in purposeful exchange. It would be worth investigating whether the same in-group/ out-group dynamics take place. That is, do out-group characters in motion also appear less human or elicit more unsettling impressions than characters belonging to one's in-group? Does the fact that the viewer has a chance to get accustomed to the characters and experience them in a variety of settings make the differences in perceived humanness disappear over time? Another extension of the current findings could come from the inclusion of emotional expressions in addition to neutral faces. Considering that displays of emotions or lack of thereof have previously been found to add to evaluations of how uncanny synthetic faces appear [62], and to what extent threatening affect is perceived in out-group members [29, 30], it would be interesting to test whether out-group members in real and artificial form elicit higher levels of moral disgust and anger than in-group members. Finally, the same study could be conducted in another culture. For instance, would Indian participants attribute greater levels of humanness to Indian faces than to Caucasian faces, reversing the results obtained in Poland?

The findings of this study suggest that accentuated realism of computer-generated faces alone may not be sufficient to capture the complexities and subtleties of human perception. The design of human-like agents therefore requires consideration of purpose-related, social psychological processes.

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