# Robots Racialized in the Likeness of Marginalized Social Identities are Subject to Greater Dehumanization than those racialized as White

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Abstract—The emergence and spread of humanlike robots into increasingly public domains has revealed a concerning phenomenon: people's unabashed dehumanization of robots, particularly those gendered as female. Here we examined this phenomenon further towards understanding whether other socially marginalized cues (racialization in the likeness of Asian and Black identities), like female-gendering, are associated with the manifestation of dehumanization (e.g., objectification, stereotyping) in human-robot interactions. To that end, we analyzed free-form comments (N = 535) on three videos, each depicting a gynoid - Bina48, Nadine, or Yangyang - racialized as Black, White, and Asian respectively. As a preliminary control, we additionally analyzed commentary (N=674) on three videos depicting women embodying similar identity cues. The analyses indicate that people more frequently dehumanize robots racialized as Asian and Black, than they do of robots racialized as White. Additional, preliminary evaluation of how people's responding towards the gynoids compares to that towards other people suggests that the gynoids' ontology (as robots) further facilitates the dehumanization.

## I. INTRODUCTION

Starting in the early 2000s, a new category of robotic platforms – androids ([1], [2]) – began to emerge in academic discourse. Characterized by their highly humanlike appearance (see, for example, Figure 1), androids offer particular value in the degree to which they can embody social cues and effect more naturalistic interactions (e.g., [3]). In addition to the possibility of literal embodiment when used as a telepresence platform (e.g., [4]), their degree of human similarity affords more realistic behaviorisms (e.g., [5], [6]), expressivity (e.g., [7]), physicality (e.g., [8]), and overall presence (e.g., [9]) than do mechanomorphic platforms. Androids represent such a design advancement that, at first glance, they frequently "pass" as human (e.g., [9], [10]).

While development of androids is still in its infancy, their increasing presence in human-robot interaction (HRI) research has both underscored and enabled research on corresponding emergent human behaviors. For example, the uncanny valley [11] – a phenomenon first noted more than 40 years ago – only began to receive attention following the release of android platforms (e.g., [12]). The uncanny valley is now recognized to significantly impact HRI social outcomes [13], such as undermining people's trust in the agent [14] and prompting overt avoidance (e.g., [15], [16]).

More recently, in sampling the general public's perceptions of androids, we have encountered even greater cause for concern, namely: people's seeming propensity for aggression towards androids [17]. Via an evaluation of 2000 free-form



Fig. 1. The Geminoid HI robot (left) alongside its originator, Hiroshi Ishiguro (right). Attribution: photograph available under the Creative Commons Attribution-NonCommercial-NoDerivs 2.0 Generic license.

comments towards a set of 24 robots (12 mechanomorphic and 12 anthropomorphic), we found aggressive tendencies to overshadow other manifestations of antisocial responding, such as the valley effect and concerns regarding a "technology takeover". The prevalence of abusive responding was further exacerbated by the androids' gendering, with upwards of 40% of commentary towards gynoids being abusive in content (evocative of gendered stereotypes, objectifying via sexualization, and/or threatening of physical harm).

#### A. Associations between Gendering and Dehumanization

Gender plays a powerful role in how people perceive, evaluate, and respond to others in human social interactions (e.g., [18], [19], [20]). Even when robots lack explicit gendering, the automaticity at which people categorize and make inferences on the basis of gender nevertheless influences the human-robot interaction dynamics. For example: genderstereotypic cues in a robot's morphology and head-style are enough to prompt the attribution of gender to an otherwise agendered robot [21], [22]; the perception of a robot as gendered prompts different evaluations of its likability [23]; and nonconformity of a robot's behavior relative to extant stereotypes associated with its gendering reduces user acceptance [24]. Thus, it is not surprising that antisocial behavior in the form of gender-based stereotyping, bias, and aggression extends to human-like interactions with gynoids.

What is surprising, however, is the frequency at and degree to which aggression towards female-gendered robots manifests. For example, in a study of a female-gendered virtual agent deployed as an educational assistant in a supervised

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Fig. 2. The three gynoids - Bina48, Nadine, and Yangyang - which are of varying racialization (Black, White, and Asian, respectively).

classroom setting, more than 38% of students were abusive in their interactions [25]. In addition to general vulgarities, the students – who were *adolescents* – often employed hypersexualizing and objectifying commentary (e.g., "shut up u hore", "want to give me a blow job", "are you a lesbian?"). Even in interactions with agendered agents, researchers have observed an association between the attribution of female gendering and abuse, wherein interlocutors appear to facilitate their aggression by invoking inexplicable gendering [26]. The observations suggest that cues of marginalizing power in human-human social dynamics can facilitate extreme dehumanization of robots as well. Thus, as robot designs have advanced to the point of near-human human similarity – wherein marginalizing cues may be explicitly encoded in the agent's appearance – there is a critical need for attention.

# B. Associations between Racialization and Dehumanization

As with features associated with gender, features associated with human racial categories are encoded in the human-based design of androids. Like gender, race (categorization based on characteristics perceived to be indicative of a particular ancestry) profoundly impacts human social dynamics. Categorization on the basis of race, as with gender, occur automatically [20] – influencing people's attitudes and behaviors [18], often without people's awareness ([28], [29]).

Like female-gendering, preliminary research indicates that racial cues, which are marginalizing in human-human interactions, are similarly marginalizing in human-agent interaction (e.g., [30], [22], [31]). For example, a recent HRI study suggests that people's anti-Black/Brown behavioral biases extend to robots racialized as Black/Brown [30]. Studies of social dynamics in interactive virtual environments (IVEs) further indicates the extensibility of racial bias (e.g., [32], [33]). For example, racist aversions are mirrored in people's interactions with avatars of corresponding racialization via reduced proxemics and compliance with requests ([34], [35]).

### C. Present Work

Given the frequency and degree to which robot-direct abuse has been observed, it is important to understand

<sup>1</sup>Per strict definitions, artificial agents – in lacking actual humanness – cannot be dehumanized. However, as people "humanize" agents automatically and without intent (e.g., [27]), it is thus possible to dehumanize them.

the associations between antisociality and the identity cues embodied by the agent. Specifically, knowing when, how, and why people respond to gendering and racialization can facilitate the interpretation and mitigation of aggression in human-robot interactions. The present lack otherwise stands in the way of meaningful and appropriate social interactions with robots. Furthermore, left unaddressed, aggression in these contexts has the potential to reinforces harmful biases in human-human interactions (e.g., [36]). We thus pursued an extension of our prior work investigating people's frequent dehumanization of gynoids ([17]) to consider the compounding impact of race-stereotypic cues.

Via an observational study of people's responding towards robots of varying racialization, we evaluated whether racial biases and overt racism extend to people's interactions with robots racialized in the likeness of marginalized social identities. To that end, we sampled public commentary on three online videos – depicting Bina48, Nadine, and Yangyang – available via YouTube.<sup>2</sup> Based on human social psychology literature (e.g., [18]), we expected that people would exhibit more frequent and extreme dehumanization of robots racialized as Asian and Black relative to robots racialized as White.

Finding support for this hypothesis, we then conducted a preliminary assessment as to whether people's responding towards the gynoids is a reflection of the sampling context (online social fora, which are marked by general verbal disinhibition [38] and hostility towards women [39], [40], [41]) or whether there is any facilitation by the gynoids' non-human ontological categorization. Specifically, we sought to test how similar people's responding to the three gynoids was in relation to women of similar identity characteristics. To that end, we additionally sampled commentary on three videos depicting women of comparable ages and racial identities to those embodied by the three gynoids.

In total, we investigated the following research questions: Do people more readily engage in the dehumanization of

<sup>2</sup>Given limited accessibility of racialized robots for and impractical methodological overhead required in a multi-platform, in-person HRI experiment, the online, observational methods were necessary to pursue the given research. Although the approach may possess less ecological validity than one involving direct, in-person human-robot interactions, comparisons of results obtained from in-person versus online testing show little difference (see, for example, [37]). This approach, in addition to enabling experimentation that is otherwise infeasible, offered further benefit via broader sampling.

TABLE I

SOURCE INFORMATION OF THE SIX VIDEOS FROM WHICH PUBLIC COMMENTARY WAS SCRAPED.

Racialization	Source Video	Release	Duration	Views	Likes	Dislikes	Comments
Black	youtu.be/G9uLnquaC84	2015	00:01:58	201K	251	67	123
White	youtu.be/cvbJGZf-raY	2015	00:01:10	331K	411	63	250
Asian	youtu.be/K53t27U1FC0	2015	00:03:56	319K	374	80	162
Black	youtu.be/mOHYTfVXGVc	2013	00:03:52	763 <i>K</i>	3.4K	111	383
White	youtu.be/e-HvL3TSf-8	2015	00:05:29	681K	4.7K	164	222
Asian	youtu.be/dfLZV00r8W4	2015	00:04:51	156K	1.3K	16	69
	Black White Asian Black White	Black youtu.be/G9uLnquaC84 White youtu.be/cvbJGZf-raY Asian youtu.be/K53t27U1FC0  Black youtu.be/mOHYTfVXGVc White youtu.be/e-HvL3TSf-8	Black youtu.be/G9uLnquaC84 2015 White youtu.be/cvbJGZf-raY 2015 Asian youtu.be/K53t27U1FC0 2015  Black youtu.be/mOHYTfVXGVc 2013 White youtu.be/e-HvL3TSf-8 2015	Black youtu.be/G9uLnquaC84 2015 00:01:58 White youtu.be/cvbJGZf-raY 2015 00:01:10 Asian youtu.be/K53t27U1FC0 2015 00:03:56  Black youtu.be/moHYTfVXGVc 2013 00:03:52 White youtu.be/e-HvL3TSf-8 2015 00:05:29	Black youtu.be/G9uLnquaC84 2015 00:01:58 201K White youtu.be/cvbJGZf-raY 2015 00:01:10 331K Asian youtu.be/K53t27U1FC0 2015 00:03:56 319K  Black youtu.be/mOHYTfVXGVc 2013 00:03:52 763K White youtu.be/e-HvL3TSf-8 2015 00:05:29 681K	Black youtu.be/G9uLnquaC84 2015 00:01:58 201K 251 White youtu.be/cvbJGZf-raY 2015 00:01:10 331K 411 Asian youtu.be/K53t27U1FC0 2015 00:03:56 319K 374  Black youtu.be/moHYTfVXGVc 2013 00:03:52 763K 3.4K White youtu.be/e-HvL3TSf-8 2015 00:05:29 681K 4.7K	Black youtu.be/G9uLnquaC84 2015 00:01:58 201K 251 67 White youtu.be/cvbJGZf-raY 2015 00:01:10 331K 411 63 Asian youtu.be/K53t27U1FC0 2015 00:03:56 319K 374 80  Black youtu.be/mOHYTfVXGVc 2013 00:03:52 763K 3.4K 111 White youtu.be/e-HvL3TSf-8 2015 00:05:29 681K 4.7K 164

robots racialized in the likeness of marginalized social identities? (**RQ1**); and Does people's dehumanization of robots differ from that of other humans? (**RQ2**).

## II. METHOD

# A. Independent Variables

We effected a quasi-manipulation of robot **racialization** (three levels: *Asian, Black, White*) via selection of videos from those of existing androids. As androids are modeled after actual people, their designs encode cues associated with racial identity. In turn, people attribute (human) racial identity to such robots (see, for example, Figure 1 which depicts Hiroshi Ishiguro, who is Asian, alongside the Geminoid HI, which is racialized as Asian). A second quasi-manipulation, **ontological category** (two levels: *human, robot*), was carried out via selection of a second set of videos depicting people of corresponding racial identities. This manipulation enabled direct, albeit preliminary, comparison of people's online behavior towards the gynoids versus other people.

### B. Materials

A total of six videos were selected for inclusion in the present study (see Table I). The exact selections and number of instances were driven by contraints of the current design space of humanoid robots. Specifically, to our knowledge, four racial identities (Asian, Black, Brown, White) are represented within the set of existing androids. There, however, exists just one platform racialized as Black (Bina48, who is female-gendered) and one racialized as Brown (Ibn Sina, who is male-gendered). To avoid gender-based confounds due to intersecting marginalization (see [19]), we optimized for representation of racial identity while holding robot gendering constant (to female-presenting). Limiting the search to gynoids, we then selected for robots most similar in approximate age (as reflected by their appearance). This yielded three gynoids - Bina48, Nadine, and Yangyang (see Figure 2) – for which we then identified three videos of similar content and metrics (release year, views, etc.).

Subsequently, we conducted a search to identify three videos depicting an Asian, Black, and White woman for comparison to the three gynoids. We again attempted to control for (i.e., maximize similarity in) age, video content, and video metrics. Due to the relative publicity of emerging robot platforms (e.g., gynoids), we focused our search towards

women of moderate celebrity and ultimately selected: an interview-style video of musician, Beyonce Knowles; a brief presentation by actor, Cameron Diaz<sup>3</sup> (for comparison with Nadine); and a featurette of model, Liu Wen, for comparison with Bina48, Nadine, and Yangyang respectively.

## C. Data Acquisition & Retention

All available comments from the six videos (N=1209) were retrieved from their respective sources on September 1, 2017. The comments were then preprocessed as follows: comments not in English or that were duplicates, indecipherable<sup>4</sup>, or unrelated<sup>5</sup> to the video content were discarded; sequential comments written by a single user (without interruption by replies and in a single timeframe) were condensed and treated as one. In total, 677 comments ( $N_{Bina}=90$ ,  $N_{Nadine}=162$ ),  $N_{Yangyang}=76$ );  $N_{Knowles}=181$ ),  $N_{Diaz}=122$ ,  $N_{Wen}=46$ ) were retained for analysis.

# D. Dependent Variables

The 677 retained comments were then each coded on two dimensions by six research assistants trained in coding, but blind to the hypotheses. Specifically, comments were coded for the **valence** of the response (positive, neutral, or negative; Fleiss'  $\kappa=.86$ ), and presence (0 or 1) of dehumanizing commentary ( $\kappa=.83$ ), which was used to compute an overall **frequency of dehumanization**. Commentary was coded as dehumanizing if it contained content that was objectifying (including overt sexualization, [42], as well as ambivalent sexism [43]), racist (i.e., evocative of race-based stereotypes [18]), and/or abusive (i.e., descriptive of verbal hostility or physical violence) towards the given agent.

#### III. RESULTS

Figure 3 shows the mean valence and frequency of dehumanizing commentary for each of the six agents. All contrasts were evaluated at a significance level of  $\alpha = .05$ .

<sup>&</sup>lt;sup>3</sup>While Diaz is of Spanish/Cuban ancestry, she is White-presenting.

<sup>&</sup>lt;sup>4</sup>For example, the comment, "FEMALES MOST LIKELY BE ON MARS[...]", on the video depicting Yangyang was discarded.

<sup>&</sup>lt;sup>5</sup>For example, a comment from a person correcting the grammar of another comment, "[@]Joel Marx The past tense is 'began'."), on the video depicting Nadine was discarded.

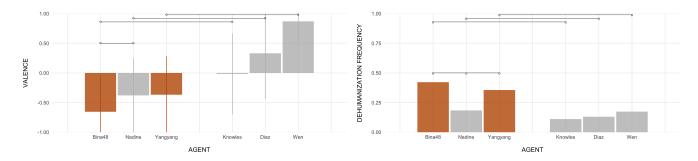


Fig. 3. Mean valence (+/- SD; *left*) and dehumanization frequency (*right*) in response to each of the six agents (from left-to-right: Bina48, Nadine, and Yangyang; Knowles, Diaz, and Wen). Bars indicate significance (amongst the planned contrasts).

Welch's t-tests<sup>6</sup> were used to compare the valence of people's responding across agents; the effect sizes for significant contrast are reported in terms of Cohen's d. To compare the proportions of dehumanizing commentary across agents we used exact binomial tests (due to the binary property of the measure). Correspondingly, "effect size" of significant binomial tests were reported in terms of RR (relative risk).

## A. RQ1: Effects of Racialization

The association between marginalizing racialization and antisocial responding towards robots was evaluated via two planned, one-tailed contrasts: responding towards Nadine (racialized as White) versus responding towards Bina48 and towards Yangyang (each of which are racialized in the likeness of identities associated with social marginalization). Specifically, based on prior research, we hypothesized that people would exhibit greater antisociality towards Bina48 and Yangyang than they would towards Nadine.

Overall, the valence of people's commentary on the three gynoids was negative irrespective of the specific robot (M =-.47, SD = .16). In particular, there was no significant difference in the valence of people's responding between Nadine (M = -.38, SD = .63) and Yangyang (M = -.37,SD = .65; t = .12, p = .89). However, consistent with prior findings indicating the extension of anti-Black/Brown biases to HRI (e.g., [30]), commentary was significantly more negative in response to Bina48 (M = -.66, SD = .60) than in response to Nadine (t = 3.35, p < .01, d = .44). Similarly, across the three gynoids, a substantial proportion of people's commentary was dehumanizing in content (M =.32, SD = .12). However, both Bina48 (M = .42) and Yangyang (M = .36) were subject to significantly more dehumanizing commentary than was Nadine (M = .18; $p < .01, RR_{Bina48} = 2.30, RR_{Yangyang} = 1.93$ ).

## B. RQ2: Effects of Ontology

We next evaluated whether people's responding towards the three gynoids was a reflection of the sampling context (e.g., due to online disinhibition [38]) or whether the

<sup>6</sup>Welch's t-test is an adaptation (of Student's) for testing whether two independent populations have equal means, without assuming equal variance. It is more reliable than Student's t-test and thus used when populations have unequal variance and sample sizes [44], as was the case in the present study. degree of antisociality is facilitated by the gynoids' nonhuman ontological identity (as robots). For each of the two measures (valence, dehumanization frequency) we computed three planned, two-tailed contrasts of the robot versus human ontological categories: responding towards Bina48 versus Knowles, Nadine versus Diaz, and Yang Yang versus Wen.

Overall, the valence of commentary on the three women was positive ( $M=.39,\ SD=.45$ ). Contrasted with commentary on the corresponding gynoids, responding was significantly more negative (p<.01) towards the robots:

- Bina48 vs. Knowles: t = 7.55, d = .99
- Nadine vs. Diaz: t = 8.43, d = 1.00
- Yangyang vs. Wen: t = 12.06, d = 2.38

Despite an overall positive valence, a non-negligable proportion of people's commentary on the three women was dehumanizing in content ( $M=.14,\ SD=.03$ ). However, the relative proportions in response to the women were markedly less (p<.01) than in response to the gynoids:

- Bina48 (M = .42) vs. Knowles (M = .11): RR = 3.82
- Nadine (M = .18) vs. Diaz (M = .13): RR = 1.40
- Yangyang (M = .36) vs. Wen (M = .17): RR = 2.04

#### IV. DISCUSSION

Here we examined the associations between racialization, ontology, and the manifestation of antisocial responding towards emergent robot platforms. Motivated by prior research, which highlights the automaticity at which bias and stereotyping extend to HRI (e.g., [27], [30], we evaluated the degree to which people responded negatively and dehumanizingly towards robots of varying racialization (Asian, Black, and White) versus other people of similar social cues.

# A. Summary of Findings

Do people more readily dehumanize robots racialized in the likeness of marginalized social identities? Across both measures (valence and dehumanization frequency), the data show a marked difference in the degree to which people respond to a gynoid racialized as Black versus one racialized as White. While the data in response to Yangyang (versus Nadine) is mixed, with a non-significant difference in valence but significant difference in the frequency of dehumanization, qualitative analysis of the commentary supports an interpretation of greater antisociality towards the Asian

gynoid. Specifically, with the proportion of dehumanizing commentary towards Yangyang nearly double that of Nadine, the data indicate that, like Bina48, people readily marginalize Yangyang. The valence of the commentary, however, indicates that the manifestation thereof is less hostile than that towards Bina48, with many of the comments containing content that is dehumanizing but delievered with a valence that is neutral to positive. For example, the comment – "Wow that's cool! But the real question is... Can you fuck it?" – is positive overall (due to "wow that's cool!"). Nevertheless, the content is dehumanizing ("Can you fuck it?"). Taken together, the data indicate general support for our hypothesis: that people readily extend racial biases and employ stereotypes to dehumanize robots implicitly racialized in the likeness of marginalized human identities.

Does people's dehumanization of robots differ from that of other people? The comparison to people's commentary on women of similar identity cues to those of the robots suggests that such responding is not simply normative behavior for the context (i.e., online disinhibition; e.g., [38], [45]). Specifically, across all three racializations, people were consistently and significantly more negative towards and dehumanizing of the gynoids relative to their human counterparts. Although these findings are preliminary and subject to important limitations, if replicated and extended, they would suggest that antisocial responding is further facilitated by the robots' lack of actual human membership.

## B. Links to Existing Literature & Broader Implications

Here we observed that: (1) racial cues, which can be socially marginalizing in human-human interactions, are associated with more negative commentary towards and a higher frequency of dehumanization of robots embodying such racializations; (2) people's responding does not appear to be a mere function of the online context in which the data was gathered. Rather, the data suggest that the agents' ontological categorization (as robots) – despite their highly humanlike appearances – facilitates greater dehumanization.

These findings are consistent with prior research indicating the automaticity at which social biases extend to and affect behavior in HRI (e.g., [17], [21], [22], [46], [30]). Moreover, the findings support indications by a growing body of literature (containing instances of unprovoked abuse towards robots – e.g., [47], [48]; as well as less empathy for robots relative to that for people when witnessing or participating in their abuse – e.g., [49], [50]) that people more readily engage in the dehumanization of robots. For example, during deployment of a service robot in an open, public environment, Salvini and colleagues observed people's interactions with the robot often escalated, without provocation, into physical abuse involving kicking, punching, and slapping the robot [48]. Brscić and colleagues observed similarly violent behavior from children in their 2015 deployment of the Robovie robot in a shopping mall [47].

Considered alongside existing literature, the findings raise several considerations for the design and development of future robots. For example, if a given robot is designed to learn from its interactions with people, guided and/or supervised learning (e.g., [51]) is warranted to avoid outcomes such as the robot developing dehumanizing tendencies. Moreover, if people are comfortable dehumanizing robots (as the present findings suggest) and do so while perceiving the robots as *human*-like, this may shape people's subsequent interactions with other people if left unaddressed (e.g., [36]).

To that end, advancing the social capacities of robots to include the ability to detect/recognize such antisociality is necessary, as is understanding of what would serve as effective robot responses. Three preliminary forrays exist: (1) Towards mitigating the frequency of robot abuse, Brscic and colleagues' implemented an avoidance-based response mechanism that proactively reduces a robot's proximity to probable abusers [47]. (2) Towards understanding effective reactive behaviors for responding to abuse, Tan and colleagues explored three common strategies (ignoring the abuser, explicit disengagement, and solicitation of empathy; [52]). (3) Towards mediating aggression in multi-person human-robot interactions, Jung and colleagues explored trialed a robot's use of verbal responses grounded in counseling literature on mediating human-human conflicts [53]. Each advance understanding of predictive factors and mechanisms for responding, however, further research is warranted.

## C. Limitations & Avenues for Future Research

While the present study provides an initial evaluation of the associations between robot racialization and dehumanizing responses, there are a number of methodological limitations necessitating further consideration. In particular, we note the preliminary nature of RQ2 (effect of ontology). The inclusion of R2 served to indicate whether antisocial responding in the context of YouTube is due to general online disinhibition [38], or is otherwise different from how people respond to other people. Nevertheless, the specific materials used may capture different responding than the average commentary on YouTube, wherein the relative celebrity of the women depicted may promote more positive responding than people might show towards non-celebrity women. Thus, replication of RQ2 with non-celebrity exemplars is needed.

## V. Conclusions

The aim of the present work was to investigate the ways in which people respond to cues of gender and race when explicitly encoded in the appearance of a humanoid robot. Consistent with prior research, we observed an association between racial cues marginalizing in human social dynamics and antisociality. Specifically, people exhibited more negative and more frequently dehumanizing responding towards Bina48 and Yangyang, which are racialized as Black and Asian, relative to Nadine (which is racialized as White). In addition, people appear to more readily engage in this manner towards robots (versus towards other people), suggesting that racial biases both extend to and are amplified in the realm of HRI. However, further research is needed towards replicating these findings and fully understanding the social impacts of such antisociality.

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