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Does the Mask Govern the Mind?: Effects of Arbitrary Gender Representation on Quantitative Task Performance in Avatar-Represented Virtual Groups

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Abstract

Virtual environments employing avatars for self-representation—including the opportunity to represent or misrepresent social categories—raise interesting and intriguing questions as to how one's avatar-based social category shapes social identity dynamics, particularly when stereotypes prevalent in the offline world apply to the social categories visually represented by avatars. The present experiment investigated how social category representation via avatars (i.e., graphical representations of people in computer-mediated environments) affects stereotype-relevant task performance. In particular, building on and extending the Proteus effect model, we explored whether and how stereotype lift (i.e., a performance boost caused by the awareness of a domain-specific negative stereotype associated with outgroup members) occurred in virtual group settings in which avatar-based gender representation was arbitrary. Female and male participants ($N = 120$) were randomly assigned either a female avatar or a male avatar through a process masked as a random drawing. They were then placed in a numerical minority status with respect to virtual gender—as the only virtual female (male) in a computer-mediated triad with two opposite-gendered avatars—and performed a mental arithmetic task either competitively or cooperatively. The data revealed that participants who were arbitrarily represented by a male avatar and competed against two ostensible female avatars showed strongest performance compared to others on the arithmetic task. This pattern occurred regardless of participants' actual gender, pointing to a virtual stereotype lift effect. Additional mediation tests showed that task motivation partially mediated the effect. Theoretical and practical implications for social identity dynamics in avatar-based virtual environments are discussed.

Introduction

AVATARS—DIGITAL AND GRAPHICAL representations of people in online environments[1–3]—constitute one of the most popular means for self-representation in computer-mediated environments. Although specific features may vary, most avatars allow users to engage in self-representations that exhibit physical characteristics of certain social categories.[4] Furthermore, many avatar-based environments provide users with customization options for their avatars,[5,6] enabling arbitrary representations of social categories such as gender.[7,8]

In popular online games (e.g., *World of Warcraft*) or virtual worlds (e.g., *Second Life*), gender bending is not an uncommon practice. Avatars in such environments function as ''identity masks,'' allowing users to represent themselves with a virtual gender identity that may or may not correspond with their actual gender.[9,10] For example, a female avatar in *Second Life*, or a male warrior in *World of Warcraft*, may not necessarily represent the actual gender of the user. As Postmes and Spears note, ''online identity is in some cases unknown, and in many other cases uncertain or unverifiable: People may not be who we think.''[11(p1074)]

Providing the means for embodiment in otherwise disembodied spaces,[12] avatars serve as the ''primary identity cue in online environments.''[13(p274)] Therefore, arbitrary representations of gender raise intriguing questions, particularly when gender-related stereotypes prevalent in the offline world become relevant. Drawing on the Proteus effect model and the concept of stereotype lift, this research investigates how arbitrary representations of gender affect stereotype-relevant performance in virtual group settings.

Effects of Arbitrary Virtual Self-Representation

Research on the Proteus effect[13]—named after the Greek god known for the ability to take on many different physical

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forms—has demonstrated that people conform to the stereotypes associated with the characteristics of their virtual self-representations, both behaviorally and cognitively. For example, those who were randomly assigned an attractive avatar acted more intimately and socially when interacting with a confederate than did those who were randomly represented by an unattractive avatar.[13] In another study, which examined the priming effects of on-screen avatars on aggression using the Thematic Apperception Test (TAT), individuals arbitrarily represented by an avatar in a Ku Klux Klan (KKK) robe generated stories of more aggressive themes than did those represented by a control avatar.[14]

More specific to the effects of gendered avatars, research showed that both females and males who were arbitrarily represented by a female avatar were more likely to conform to female-typed language norms (e.g., reference to emotions, use of apologies) when compared to those represented by a male avatar.[15] Furthermore, analyses on game players' behaviors in multiplayer online gaming environments revealed that male avatar players were more likely to engage in killing, while players using female avatars were more likely to engage in healing activities. These patterns were observed regardless of the players' actual gender, indicating that people tend to conform to stereotypic expectations associated with the virtual gender identity of their avatars.[16]

Extending these lines of research, we investigated whether avatar-based virtual gender representations can influence cognitive performance associated with gender-related stereotypes. One of the most prevalent domain-specific stereotypes associated with gender concerns quantitative abilities (e.g., ''females tend to underperform on quantitative tasks compared to males'').[17] Will arbitrary gender representations affect avatar users' quantitative performance in virtual group contexts? In addressing this question, we draw on the concept of stereotype lift.

Arbitrary Gender Representations and Virtual Stereotype Lift

Stereotype lift refers to situations in which individuals experience a performance boost caused by a negative outgroup stereotype.[18] Rooted in nonstereotyped group members' downward comparison with outgroup members negatively stereotyped in a particular domain, the effect occurs when a negative stereotype associated with an outgroup is made salient, or when a task is presented as diagnostic of an ability associated with such a stereotype.[18] The effect has been established in various domains associated with gender disparities such as spatial abilities (e.g., mental rotation[19] and navigation[20]) and, more pertinent to the present research, quantitative abilities.[21] The effect, however, has mostly been observed in solitary performance contexts offline, and has not yet been explored in virtual group settings.

Findings of the Proteus effect research guide us to predict that ''virtual'' stereotype lift might occur in virtual groups. Specifically, we expect that male avatar users *competing against* female avatars are likely to show a performance boost on a task presented as diagnostic of an ability domain in which females are negatively stereotyped. Particularly in ad hoc groups, gender-based perception of self and others is likely to be greater in mixed-gender groups compared to same-gender groups.[15,22,23] Also, research documents that stereotype lift is more likely to arise when situational/contextual factors activate the stereotype-free social identity for nonstereotyped individuals.[24] Given this, competitive contexts, which tend to amplify ingroup–outgroup differentiation,[25] may serve as a condition that can activate virtual gender identity and thereby induce virtual stereotype lift. We therefore hypothesize:

H1: Those who are represented by a male avatar and compete against female avatars will perform better than others on a quantitative task.

Additionally, we explore a possible causal mechanism underlying the effect. Walton and Cohen noted that when nonstereotyped group members perform a task relevant to a domain in which an outgroup is known to underperform, their motivation for performing the task may increase, which, in turn, can boost their actual performance.[18] Noting this, we test the possible mediating role of task motivation in virtual stereotype lift in avatar-based group settings:

H2: Task motivation will mediate the virtual stereotype lift effect.

Method

Participants and design

One hundred and twenty students (60 male, 60 female) at a large U.S. university participated in the experiment. This sample (age 18–30 years; $M_{age} = 20.59$; $SD_{age} = 2.15$) consisted of 58.3% Caucasians, 28.3% Asians, 8.3% Hispanics, and 5.1% bi- or multiracial individuals.

Participants were randomly assigned to a 2 (participant gender: female vs. male) $\times$ 2 (avatar gender: lone-female vs. lone-male) $\times$ 2 (performance context: competition vs. cooperation) between-participants design. We manipulated avatar gender such that the participant avatar was placed in a group of three with two opposite-gendered avatars, putting the gender of the participant avatar in a numerical minority status. This maximized the salience of the virtual gender cues.[26,27] In manipulating performance context, we employed a cooperative context as a comparison condition for the competitive context. By doing so, we could ensure that all participants performed the task with comparable goal orientations while varying the levels of ingroup–outgroup differentiation.[28] The competition condition instructed participants to outperform their co-actors on the task, while the cooperation condition instructed participants to help their team outperform other participating teams.

If virtual stereotype lift were to be found, we should only observe a significant two-way interaction between avatar gender and performance context, and the three-way interaction involving participant gender should not reach significance.

Avatar pretest

Prior to the experiment, we pretested the appearance of the avatars. Fourteen judges rated the avatars' appearance on attractiveness and perceived intelligence. Repeated-measures analysis of variance (ANOVA) confirmed that the avatars did

not vary significantly on either of the characteristics, $F < 1.17$, $p > 0.33$.

Material and procedure

Participants, represented by either a female or a male avatar, solved 20 mental arithmetic problems (i.e., hand calculation and calculator use were prohibited) with a 10-minute limit in the presence of two ostensible co-actor avatars. These avatars, in actuality, were preprogrammed images. Past research showed that stereotype-relevant ability diagnostic tests tend to be automatically associated with negative stereotypes.[18] Hence, we informed the participants that the mental arithmetic problems were designed to assess quantitative abilities.

To maximize perceived arbitrariness of avatar gender, we masked avatar selection as a random drawing. Participants were informed that three female avatars and three male avatars were hidden behind six ''unknown'' buttons on the screen (Fig. 1). Then, participants were instructed to click one of these buttons to determine the avatar they would be using. Regardless of their choice, participants' avatar gender was predetermined according to the experimental condition to which they had been randomly assigned.

The experiment interface featured an animated log-on screen, which was designed to increase the believability of the co-actors. The screen displayed a countdown timer, allowing participants to keep time. Each question was presented on a separate page. Participants submitted their answer to a question and clicked on the ''submit'' button, which led them to the next question.

To remind participants of the ''presence'' of the co-actors, all three (i.e., the participant's and the two ostensible co-actors') avatars were presented on the screen throughout the problem-solving session (Fig. 2). Additionally, participants were informed that whenever an answer was submitted by a participant, that person's avatar would blink once. This blinking feature—an animation embedded in the system—was employed to engage participants better in the problem-solving activity. The experiment interface was programmed such that the frequency and sequence of blinking were identical across all experiment conditions (see Table 1).

After the problem-solving session, participants were directed to the postexperiment questionnaire, which included manipulation-check items, self-report measures, and a question on participants' SAT math scores (i.e., a covariate to adjust for preexisting quantitative abilities). Upon completion, participants were debriefed and thanked.

Measures

Quantitative performance was assessed with the number of correctly answered items on the 20 mental arithmetic problems. Following past research (e.g., Krendl et al.),[29] the problems were based on borrow and carry operations (multidigit addition, subtraction, and multiplication).

Task motivation—our proposed mediator—was measured with three items (e.g., ''I was motivated to do my best on this task'') adapted from Marx and Goff[30] on a 7-point scale, ranging from 1 = ''strongly disagree'' to 7 = ''strongly agree''; the items ($\alpha = 0.80$) were averaged.

Results

Manipulation checks

Avatar gender manipulation was checked with questions about the avatars used in the stimuli, and all participants correctly recognized the avatar they used as well as the co-actor avatars. Performance context manipulation was checked with two items rated on a 7-point scale (1 = ''describes very poorly'' to 7 = ''describes very well''): ''My primary goal was to beat the other players in my group'' (competition) and ''My primary goal was to do my best to help raise the total score of our group'' (cooperation). On the competition item, the competition participants ($M = 5.45$, $SD = 1.86$) gave significantly higher ratings than did the cooperation participants ($M = 3.42$, $SD = 1.96$), $t(118) = 5.83$, $p < 0.001$, Cohen's $d = 1.07$. Conversely, on the cooperation item, the cooperation participants gave significantly higher ratings ($M = 5.02$, $SD = 1.79$) than did the competition participants ($M = 2.38$, $SD = 1.80$), $t(118) = 8.03$, $p < 0.001$, $d = 1.48$.

Quantitative performance

Initially, we conducted a three-way (participant gender × avatar gender × performance context) analysis of covariance (ANCOVA), including participants' SAT math scores as a covariate (e.g., Inzlicht and Ben-Zeev[26] and Wout et al.[31]; see Table 2 for means with/without covariate adjustment). The only significant main effect was that of avatar gender: lone male avatar participants ($M_{adj} = 15.12$, $SE = 0.35$) scored

FIG. 1. A screenshot of the avatar selection phase.

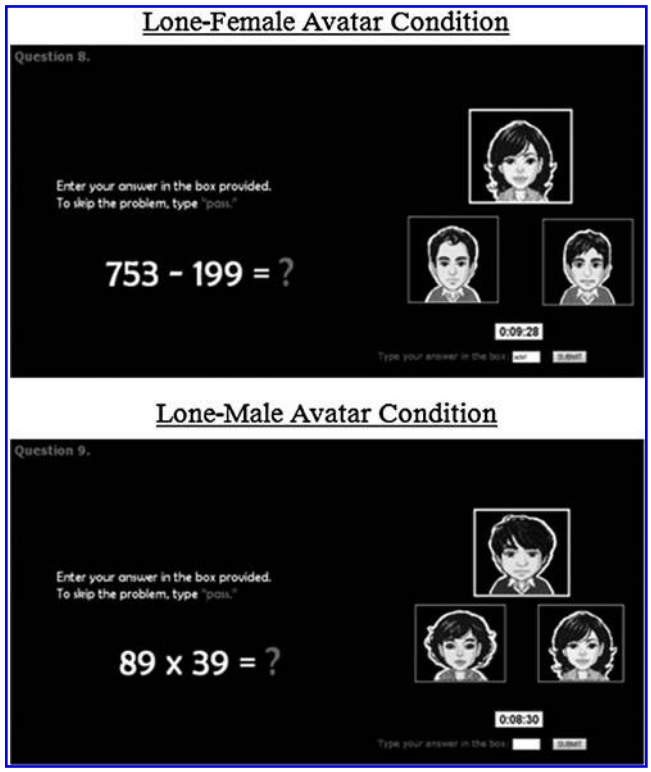

FIG. 2. Sample screenshots of the experiment interface and the avatar triads.

higher than lone female participants ($M_{adj} = 12.07$, $SE = 0.35$), $F(1, 111) = 4.58$, $p < 0.04$, $\eta^2 = 0.03$. This main effect was qualified by a significant avatar gender–performance context interaction, $F(1, 111) = 5.49$, $p < 0.03$, $\eta^2 = 0.04$. The three-way interaction (participant gender × avatar gender × performance context) was not significant, $F(1, 111) = 0.12$, $p = 0.73$, $\eta^2 < 0.001$, indicating that the avatar gender–performance context interaction did not differ as a function of participant gender (Fig. 3).

To test our prediction of virtual stereotype lift directly, we performed a planned contrast. In consideration of the nonsignificant three-way interaction and the significant avatar gender–performance context interaction, the data were collapsed across participants' actual gender. The planned contrast then compared the lone male avatar/competition condition against the other conditions on the standardized residuals derived from a simple regression in which the performance scores were regressed on the covariate. Weights applied to the contrast were: 3 (lone male/competition), −1 (lone male/cooperation), −1 (lone female/competition), −1 (lone female/cooperation). This contrast revealed a significant difference between the lone male/competition participants and the rest, $t(116) = 3.31$, $p < 0.01$, supporting H1.

Table 2. Means and Standard Deviations of Key Variables

			Task performance	
			M (M_{adj})	SD
Lone male avatar	Competition	Male	17.27 (17.12)	2.55
		Female	14.60 (14.89)	1.96
	Cooperation	Male	14.20 (13.96)	2.73
		Female	14.73 (14.49)	3.01
Lone female avatar	Competition	Male	13.93 (13.86)	2.49
		Female	13.13 (13.77)	2.95
	Cooperation	Male	13.40 (13.32)	3.76
		Female	15.47 (15.32)	2.42

Note. $N = 120$. M_{adj} values denote covariate-adjusted means.

Mediation analysis: the role of task motivation

We used the procedure recommended by Baron and Kenny[32] and tested whether task motivation played a mediating role (Fig. 4). Guided by the results of the planned contrast test, we dummy-coded the four conditions by assigning 1 to the lone male avatar/competition participants and 0 to others. This avatar/context dummy variable significantly predicted both task motivation, $\beta = 0.22$, $p = 0.01$, and arithmetic performance, $\beta = 0.28$, $p = 0.001$, while controlling for the covariate. Task motivation also significantly predicted arithmetic performance while controlling for the covariate, $\beta = 0.35$, $p = 0.0001$. Controlling for task motivation, the association between the avatar/context dummy variable and arithmetic performance was reduced, albeit still

Table 1. Description of the Blinking Feature Used in the Experiment Stimuli

Version	*Description of the blinking features*
1	Neither of the simulated co-actors' avatars blinked
2	The co-actor avatar on the *left* blinked once; after a 30-second interval, the co-actor avatar on the *right* blinked once
3	The co-actor avatar on the *right* blinked once; after a 30-second interval, the co-actor avatar on the *left* blinked once

Note. One of the three versions was shown on each question page (as shown in Fig. 2) in the order of 1→2→3→2→1…during the problem-solving session. For example, when participants were solving Question 1, Version 1 was presented, and when participants were solving Question 2, Version 2 was presented.

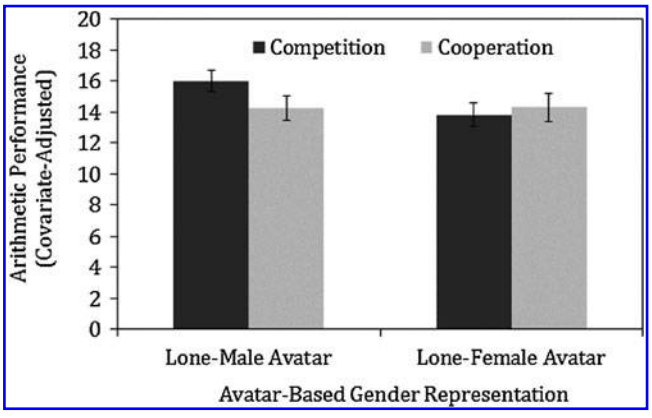

FIG. 3. Effects of avatar gender and performance context on mental arithmetic performance scores.

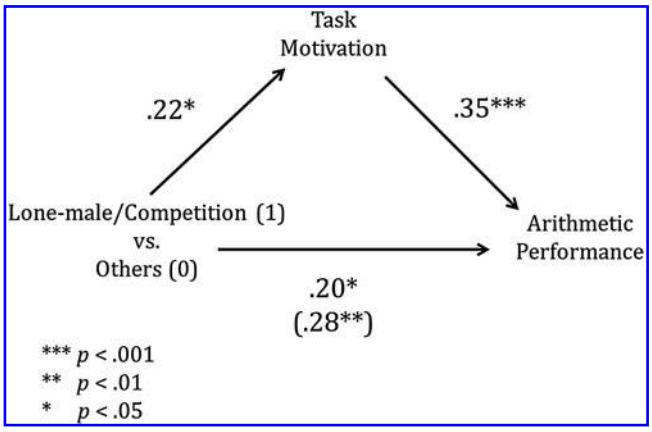

FIG. 4. Mediational analysis with task motivation as a proposed mediator.

significant, $\beta = 0.20$, $p = 0.01$, suggesting partial mediation (Sobel's $Z = 2.16$, $p = 0.03$).

In addition, we conducted bootstrapping analyses recommended by Preacher and Hayes.[33] A 95% bias-corrected confidence interval generated with 5,000 bootstrap resamples was constructed around the unstandardized indirect effect of the avatar/context dummy variable on arithmetic performance through task motivation. This confidence interval did not include zero [CI 0.14, 1.06], confirming a significant partial mediation for H2.

Discussion

Summary of findings

The results revealed that participants arbitrarily represented by a male avatar, when competing against ostensible virtual female co-actors, exhibited a significant boost on the mental arithmetic task. The nonsignificant three-way interaction involving participant gender indicated that the significant interaction between avatar gender and performance context operated equally for both genders, suggesting that stereotype lift may occur in virtual environments involving arbitrary gender representations. This effect was partially mediated by task motivation.

Theoretical and practical implications

The present research has several theoretical implications. First, the findings show that people's susceptibility to arbitrary self-representation based on avatars as posited by the Proteus effect model may extend to the domain of cognitive performance relevant to gender stereotypes. This effect occurred when the presentation of the mental arithmetic problems as a gender-stereotyped task was subtle (i.e., just mentioning test diagnosticity).[18,21] Even when the negative stereotypes against females' quantitative abilities were not made explicit, male avatar users performed better than others on the task when the performance context activated their *virtual* social self (i.e., virtual male identity). This pattern echoes what past research on stereotype lift has found (e.g., Marx and Stapel[24]).

Our research also demonstrated that task motivation partially mediated the effect. This suggests that even when avatar-based gender representations are arbitrary, wearing a ''mask'' representing a social category membership that is free of negative stereotyping (relative to a negatively stereotyped virtual identity) can be positively motivating.

Also noteworthy is that our findings did not reveal virtual stereotype *threat*. Stereotype threat, which is a ''mirror image'' of stereotype lift,[24(p788)] refers to a type of psychological threat induced by situations in which negative stereotyping of a group leads its members to suffer underperformance because of the anxiety about confirming the stereotype.[34] Research shows that contextual cues such as outnumbering presence of non-stereotyped outgroup individuals can trigger the threat by making the negatively stereotyped group identity *distinctive* (e.g., Inzlicht and Ben-Zeev[26] and Inzlicht and Good[35]). If virtual stereotype threat had been induced in our study, participants who were represented as virtual females and competed against virtual males should have performed significantly worse than others. Such a pattern, however, did not emerge. In future investigations, it will be important to specify when people are more (or less) likely to conform to negative stereotypes associated with their virtual self-representations.

This research also has practical implications. As avatar-based virtual environments are increasingly being used in various areas beyond entertainment—including education/training and work[2,36,37]—our findings point to new opportunities for leveraging the power of avatar-based identity representations. In particular, the present research may be able to guide efforts to structure virtual group settings that could potentially benefit individuals who are negatively stereotyped in certain domains.[38]

Limitations and future directions

Our research has several limitations that should be noted. First, our data come from a convenience sample of college students, and therefore lack representativeness. In addition, it is likely that participants' personal characteristics—such as participants' predispositions concerning the stereotype on gender and quantitative abilities and prior experience with video games/virtual worlds—might have influenced the results as intervening variables. These issues may limit the generalizability of our findings.

Second, our experiment setting did not allow us to take participants' relationship with their avatars into consideration. Video game research has demonstrated that character attachment and avatar self-identification can have important motivational and behavioral consequences.[39–41] Given this, the extent to which avatar users establish psychological connection with their avatars could play a critical role in the effect of avatar-based social category representations on performance in stereotype-relevant domains, as one's relationship with his/her avatar could affect the sense of control and responsibility, which, in turn, could influence cognitive functioning and motivation. This remains an intriguing question that should be addressed in future research.

Third, our manipulation of performance contexts employed cooperation as a comparison condition for competition. Although this approach allowed us to keep participants engaged in the task with comparable goal orientations, an independent co-action condition involving neither competition nor cooperation[42] could further specify whether and how different performance contexts contribute to people's assimilation to arbitrary virtual identities in group environments.

Finally, future research should explore the role of perspective (first person vs. third person). Research conducted in immersive virtual reality (IVR) has demonstrated that a first-person perspective, compared to a third-person perspective, is significantly more powerful in inducing a body transfer illusion, even when males associated themselves with a virtual human female body.[43] Considering that our experiment stimuli were exclusively based on a third-person perspective, it will be intriguing to examine whether a first-person perspective can facilitate the effects of virtual stereotype lift to an even greater extent.

Conclusion

The present research demonstrates that the ''identity masks'' associated with stereotypes can influence cognitive performance of those who wear the ''masks.'' As computer-mediated interactions are increasingly becoming embodied with avatars, further investigations on how social and cultural stereotypes translate into avatar-based online environments will provide valuable insights into understanding the challenges and opportunities arising in the social identity dynamics of the virtual realm.

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Author Disclosure Statement

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