Anticipated Discrimination, Choices, and Performance: Experimental Evidence*

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Abstract

This paper studies experimentally whether potential perceived discrimination affects decisions in a labor-market setting with different stereotypes. Participants are assigned to a seven-person group and randomly allocated a role as a firm or worker. In each group, there are five workers and two firms. The only information firms have about each worker is a self-selected avatar (male, female or neutral) representing a worker's gender. Each firm then decides which worker to hire. Female workers react to potential discrimination when they know the task is math-related, but not otherwise. Men choose similar avatar patterns regardless of the task. Men do perform at much higher levels in the math-related task, but there is no difference in performance in the emotion-recognition task, where there is a strong female stereotype.

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1. Introduction

A recent and growing literature points to expectations as an important predictor of educational choices, showing that, along with ability perceptions, beliefs about future earnings are one of the determinants of choices of college major (Arcidiacono *et al*., 2012; Zafar, 2013; Wiswall and Zafar, 2015). Among other factors affecting beliefs, stereotypes (Bordalo *et al.*, 2016; Coffman, 2014) and related discrimination issues (Bohnet, van Geen, and Bazerman, 2016; Reuben, Sapienza, and Zingales, 2014) have been extensively analyzed in the literature.[1]

While stereotypes and labor-market discrimination have been already documented, nevertheless little is known regarding whether and how people react when they perceive potential discrimination.[2] This anticipation could be even more important than the discrimination itself for the agents' decision process. Consider, for example, the case of science, technology, engineering, or mathematics (STEM) careers.[3] A woman who anticipates that she will face discrimination (either a lower probability of being hired or a higher probability of getting a lower salary than her male counterpart) in a particular field might react strategically to this perceived discrimination by reducing the likelihood of choosing a degree that relates to that particular field.

Different factors have been proposed to explain the low representation of women in science. First, gender differences in preferences have been extensively analyzed in the literature as an explanation for the self-selection into math-oriented activities. Second, it is possible that men have better aptitudes for science-related tasks; however, the evidence is not conclusive on this matter. Some studies find that males perform better, particularly with respect to being in the top of the distribution than females, while other studies indicating that there are no significant gender differences in performance.[4] Bordalo *et al.* (2016) consider that men being over-

[1] See also the extensive literature on statistical discrimination (Lundberg and Startz, 1983; Phelps, 1972; Aigner and Cain, 1977; Cornell and Welch, 1996; Pinkston, 2003; or Coate and Loury, 1993)

[2] In a recent unpublished paper, Alston (2019) studies individuals' willingness to pay to hide/include their gender in resumes in an experimental setting. The author finds that, unlike men, women are willing to forfeit part of their salary to hide their gender. This seems rather similar to our results regarding the choice of an avatar.

[3] There are strong differences across gender in the likelihood one pursues STEM careers, with males choosing courses and degrees with a strong mathematical component far more often than do females. These differences emerge at high school (Buser, Niederle and Oosterbeek, 2004; Joensen and Nielse, 2011) and remain at the college level (Zafar, 2013). This gap further widens at the graduate-school level (Hill *et al.*, 2010).

[4] For the first category, see for example Hedges and Nowel (1995), Xie and Shauman (2003), Ellison and Swanson (2010), Guiso, Monte, Sapienza, and Zingales (2010), and Grosse, Riener, and Dertwinkle-Kalt (2014). For the second category, see for example Hyde and Mertz (2009), Hyde *et al*., 2008, and Guiso *et al.*, 2008

represented at the top of the distribution could lead one to exaggerate the difference, perhaps leading to the stereotype that male (female) performance in math is high (low).

This paper offers an alternative explanation of why it is less likely for females to choose a STEM major. Rather than focusing on discriminatory behavior, we study experimentally whether men and women react by making strategic decisions when they face a situation of potential discrimination. In particular, we study whether subjects in a labor-market setting hide (or reveal) their gender. Moreover, we also study how the decision to hide one's gender depends on the task. Participants were allocated to a group of seven people and randomly assigned a role as a firm or worker. In each group, there were five workers and two firms. Firms could hire one worker to perform a task in a subsequent stage. The only information that firms had about the workers was an avatar signaling a worker's gender. Prior to the firms making their decisions, the workers chose the avatar that would represent them in the market. Each worker could choose: *(i)* a male avatar, *(ii)* a female avatar, or *(iii)* a neutral avatar.[5] Workers' profits were larger if they were hired by a firm than if they were not, and this was common information to all workers.

In our design, we vary the information that workers receive about the task when they pick the avatar. In the first treatment, workers know that they will be hired to perform a mathematical task that consists of adding five two-digit numbers over a five-minute period, which carries a male gender stereotype (Correll, 2001; Rudman *et al.*, 2001; Kiefer and Sekaquaptewa, 2007). The task is the same in the second treatment, but the workers did not receive information about the task. In the third treatment, workers know that they will be performing a task consisting of identifying emotions depicted on individuals' faces, which carries a female gender stereotype (Gigerenzer *et al*., 2013; Halladay, 2017; Bordalo *et al.*, 2016a).

Given the stereotype that males are better at math-related tasks and that females are better at emotion recognition, one might expect that male avatars would be the typical choice in the summing-numbers task and that female avatars would be the typical choice in the emotion-recognition task. As a consequence, we conjecture that, when the task to be performed is math-related, male workers are more likely to truthfully report their gender than are female workers. In the emotion-recognition task, female workers are more likely to truthfully report their gender

[5] The use of avatars in an experiment is not new. For example, Fiedler and Haruvy (2009) or Fiedler et al. (2011), conduct experiments in a virtual world to study subjects' behavior in a Trust Game.

than male workers. Finally, when workers are not informed about the task they will perform, we should observe significantly weaker gender differences (if any) in reporting the true avatar.

Our results show that men and women react differently when they face potential discrimination. When the task is math-oriented and workers have information regarding the task, males do indeed self-identify almost twice as often as females. However, these gender differences disappear in the other two treatments and people largely choose same-gender avatars. When the workers do not know the task prior to the avatar choice, the proportions of male and female avatars chosen were identical, at 42.9%. Finally, one might expect males to pretend to be females in the emotion-recognition task, but they do not do so. Although females chose the female avatar in most of the cases (64.1%), the majority of males (67.3%) still picked the male avatar, despite the fact that women are considered to be better at identifying emotions.[6] These results would suggest that most women choose avatars strategically, hiding their gender when the task is male-oriented, but that men do not hide their gender in the female-oriented task. Interestingly, we also find that the strategic behavior of women does not depend on ability.

Additionally, even considering the limitation of our results regarding the hiring decisions, we see no evidence of discrimination against female avatars. Perhaps surprisingly, firms do not discriminate against female avatars in the math task, despite (female) workers' expectations. There is also no gender discrimination in the emotion-recognition task.

The remainder of the paper is organized as follows. Section 2 gives the experimental design, while section 3 presents the main results and some discussion. We conclude in section 4.

2. Experimental design and procedures

2.1 Experimental design

The experimental design consists of three treatments: the Math-Information Treatment (*MIT*, hereafter), the Math-No-Information Treatment (*MNIT*, hereafter), and the Emotions-Information Treatment (*EIT*, hereafter). All three treatments involved a real-effort task.

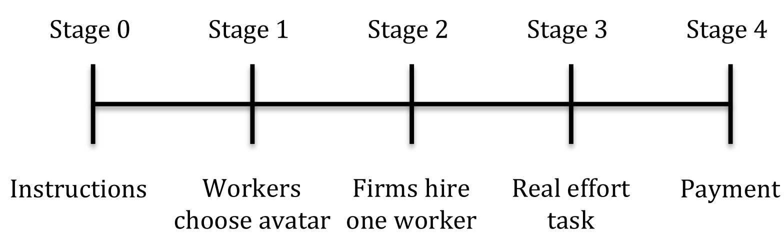
In *MIT*, participants were allocated into groups of seven people and randomly assigned a role as a firm or a worker. Each group was composed of five workers and two firms. Each firm

[6] Our own survey evidence, presented in Appendix C, strongly indicates that the emotions task carries a clear female stereotype in this population.

could hire only one of the five workers, who would then add five two-digit numbers for five minutes (Niederle and Vesterlund, 2007).[7] Participants could not use calculators or scratch paper. Both firms and workers were paid on a piece-rate basis. Firms and workers who were hired were paid 1.5 GBP for each correct sum that workers did. Workers who were *not* hired by a firm would do the same task, but would only be paid 0.5 GBP per correct sum. We chose adding five two-digit numbers because this task carries the stereotype that men perform better (Correll, 2001; Rudman *et al.*, 2001; Kiefer and Sekaquaptewa, 2007).

When deciding whom to hire to perform the task, the only information firms had about a worker was an avatar signaling the worker's gender.[8] Each worker had previously chosen an avatar (male, female, or neutral) that would represent him or her in the market.[9] We chose to use avatars as a key feature of our design because they allow workers to be represented in the labor market by their preferred gender, without having to explicitly state the gender.[10,11]

Figure 1. Structure of the experiment.



When choosing the avatar, workers had information regarding: *(i)* the task they would perform, *(ii)* the size and composition of the group (number of firms and workers), *(iii)* the fact that each firm could only hire one worker, *(iv)* the payoff scheme and *(v)* the fact that firms did

[7] In the hiring stage the firm who first chose one worker was matched with that worker and this continued.

[8] Workers in the experiment were not explicitly told that the avatar was signaling their gender. They were told only that an avatar would represent them in the market. The instructions in Appendix A offer more details.

[9] See Appendix B for the avatar alternatives.

[10] Lim and Harrell (2015) investigated the behavioral patterns of individuals who construct their avatars, including preferences for a particular avatar gender, and looked at the connections between these behavioral patterns and the participants' true gender identities. In our design, preferences would be the same across treatments, changing only the strategic considerations of the avatar.

[11] The reason behind offering the possibility of a neutral avatar was to present an intermediate mechanism for a worker to not reveal his or her gender without active misrepresentation. Identity considerations (Akerlof and Kranton, 2000; Charness, Rigotti, and Rustichini, 2007; Chen and Li, 2009) suggest that it is likely to be costly for one to choose an avatar that is not one's actual gender. We felt that the cost of choosing a neutral avatar would be considerably lower than choosing an avatar from the other gender. This is a standard practice in companies that allow workers to not report their gender, race or religious preferences when applying for a job.

not know that the avatar was chosen by the worker. Note that workers had not experienced the task when choosing the avatar. The task was performed only once, after the hiring stage was over. Figure 1 provides a summary of all stages in the experiment.

MNIT was the same as *MIT* except that workers had no information about the nature of the task they would perform (in the third stage) when they chose avatars.[12] In this treatment, when choosing avatars, workers had information about: *(i)* the size and composition of the group (number of firms and workers), *(ii)* the fact that each firm could only hire one worker, *(iii)* the fact that their earnings could potentially be three times larger if they were hired than if they were not and *(iv)* the fact that firms did not know that the avatar was chosen by the worker.

EIT was the same as *MIT* with the only difference being that the task performed by the workers in the third stage was not math-related. In *EIT*, workers would perform a real-effort task consisting of identifying emotions from faces. The facial emotion task utilizes professionally classified images obtained from The Great Good Science Center at the University of California, Berkeley.[13] Workers were shown 15 faces, each appearing on the screen for two seconds, and subjects attempted to correctly select the depicted emotion out of four options. Subjects had 20 seconds to submit an answer after each image was displayed. They were (accurately) told that the same emotions could repeat but the same image would never appear more than once. As in the other treatments, firms and hired workers would earn 1.5 GBP per correct emotion identified and each non-hired worker would earn 0.5 GBP per emotion. This task was chosen since, contrary to the math task, it carries a gender stereotype that women will perform better than men (Halladay, 2017; Gigerenzer *et al.*, 2013, Bordalo *et al.*, 2016a).

2.2 Procedures

The experiment was conducted at the University of Exeter with 434 participants, who were recruited using the online recruitment system ORSEE (Greiner, 2015). The experiment was programmed and conducted with z-Tree (Fischbacher, 2007). We conducted a total of 20 sessions with 21 subjects (6 firms and 15 workers) in each; we also had one session with 14 participants (4 firms and 10 workers). Subjects could see the composition of the session when entering the lab. The gender composition of all sessions was always the same, 50% male

[12] Note that, in this treatment, firms knew the task that workers would perform when hiring them.

[13] We thank Brianna Halladay for granting us access to the material she had obtained from the Center.

participants and 50% female participants.[14] No individual participated in more than one session. On average, each person received 10.5 GBP for a session that was 45 minutes or less. Table 1 summarizes the number of sessions and observations for each treatment for each gender.

Table 1. Experiment summary

Treatment	# sessions	# workers (male)	# workers (female)	# workers (total)	#firms (male)	#firms (female)	#firms (total)
MIT	7	50	50	100	20	20	40
MNIT	7	52	53	105	21	21	42
EIT	7	52	53	105	21	21	42

3. Results

This section is structured as follows. We first analyze the avatar choice. Second, we look at firms' decisions regarding whom to hire. Finally, we study workers' performance. Table 2 summarizes the avatar choices made by the workers. Specifically, we report the percentage of workers choosing a male, a female, or a neutral avatar. We perform this analysis for both male and female workers.

Table 2. Summary statistics

	MNIT Avatar			*MIT Avatar*			*EIT Avatar*		
	Male	Female	Neutral	Male	Female	Neutral	Male	Female	Neutral
Males	59.62%	21.15%	19.23%	68.00%	10.00%	22.00%	67.30%	13.46%	19.23%
Females	26.42%	64.15%	9.43%	40.00%	36.00%	24.00%	26.42%	64.15%	9.43%

How to read this Table: The leftmost column shows that, in the *MNIT* treatment, 59.62% of all males chose the Male avatar, while 26.42% of all females chose the Male avatar. The middle column shows that, in the *MIT* treatment, 10.00% of all males chose the Female avatar, while 36.00% of all females chose the Female avatar.

[14] Note that in each 21-person session there was one extra male or female participant. We chose the gender of the extra participant in each session randomly. However, note that participants were told that they would be allocated to groups of seven subjects. So, even if they could see the gender composition of the session, it was impossible for them to know the gender composition of their group.

3.1. Avatar choices

3.1.1 Numbers task

In this subsection, we look at workers' avatar choices in the adding-numbers task according to whether the task is known or unknown.

The left panel in Table 2 shows that there is no significant difference in self-identification rates across gender (Z = -0.476, p = 0.634, Mann Whitney test) when workers do not have any information regarding the math-related task, with 59% of males (64% of females) choosing a male (female) avatar.[15] In this treatment, we also observe some differences in the choice of neutral avatars. Males chose a neutral avatar twice as often as females, 19% versus 9%, but this difference is not statistically significant (Z = 1.427, p = 0.153, Mann-Whitney test).

Result 1: *When workers do not know the task, there are no significant differences between the avatar-choosing behavior of male and female workers. Neither the self-identification rates nor the percentage of neutral avatars chosen are significantly different across genders.*

In *MIT*, workers know that the task to be performed is math-related and matters change dramatically. As shown in the middle panel in Table 2, although the percentage of males choosing a male avatar goes up to 68%, the change is not statistically significant (Z = 0.876, p = 0.381, Mann-Whitney test).[16] However, there is a deep reduction for female workers in the self-identification rate, dropping from 64% in *MNIT* to 36% in *MIT*. This difference is highly-significant (Z = -2.842, p = 0.004, Mann-Whitney test), and so a much higher percentage of male workers report their true gender in *MIT* (Z = -3.187, p = 0.001, Mann-Whitney test).

Moreover, in *MIT*, female workers choose a male avatar 40% of the time, which is a 50% increase over *MNIT;* they also choose the neutral avatar 24% of the times, which is twice as frequent as in *MNIT*. While the difference between treatments is not statistically significant for male avatar choices (Z = 1.458, p = 0.145, Mann-Whitney test), these are significant for the choice of neutral avatars (Z = 1.981, p = 0.048, MW test). These results show that when female workers decide not to report their true gender, they sometimes instead opt for the alternative of hiding their gender without explicitly making a false indication.

[15] Here and elsewhere, we round p-values to the third decimal place; tests are two-tailed unless otherwise indicated.
[16] The proportion of female (10%) and neutral (22%) avatars chosen by males in *MIT* is also not significantly different from that in *MNIT* (Z = -1.541, p = 0.123, and Z = 0.344, p = 0.731, Mann-Whitney test for the choice of female and neutral avatars, respectively).

Result 2: *When it is common information that the task is math-oriented, male workers do not change their behavior significantly compared to the control treatment. Female workers, however, significantly decrease (increase) the proportion of female (neutral) avatars chosen.*

3.1.2 Emotion-recognition task

In this subsection, we analyze workers' avatar choices when the task is more female-oriented. As shown in Table 2, the choice of the avatar in *EIT* is similar to that in *MNIT,* when workers do not have information about the task. In *EIT*, 67.30%, 13.46% and 19.23% of males choose the male, female and neutral avatars, respectively; these figures are 59.62%, 21.15%, and 19.23% in *MNIT*. None of the pairwise differences across the two treatments is statistically significant (Z = -0.811, 1.032, and 0.000, p = 0.418, p = 0.302, and p = 1.000, respectively, Mann-Whitney test for the proportion of male, female and neutral avatars chosen).

A similar result is found for female workers' choices. In *MNIT*, the percentage of women choosing a male, female and neutral avatar is 26.42%, 64.15% and 9.43%, respectively. The equivalent percentages in *EIT* are identical, so again there are no significant differences across treatments (Z = 0.000, p = 1.000, Mann-Whitney test). As a result, a similar percentage of male and female workers report their true gender in *EIT* (Z = -0.339, p = 0.734, Mann-Whitney test).

Result 3: *When the task is female oriented both male and female workers behave similarly to the case with no task information.*

Next, we provide an econometric analysis to better understand workers' avatar decisions. Table 3 reports the results of a multinomial logit model, to study the likelihood of subjects' choosing a true, neutral or opposite avatar (opposite avatar served as a reference category).

We use the following explanatory variables: *Male*, a binary covariate that equals 1 if the worker is male, and 0 otherwise; *STEM*, a dummy with the value 1 if the worker is currently studying a degree in Science, Technology, Engineering or Mathematics, and 0 otherwise; *# Correct answers,* a proxy for workers' expected own productivity in the real effort task; the interaction between *# Correct answers* and *Male;* and *Treatment1 (Treatment3)*, with value 1 if *MIT* (*EIT*) and 0 otherwise. We also add an interaction between *Male* and *Treatment1 (Treatment3)* in order to determine whether the information about the task that workers receive prior to choosing the avatar affects males and females differently.

Table 3. Multinomial logit regressions on reporting true, neutral, and opposite avatar

Constant	truthful	1.183** (0.510)
Male		-0.277 (0.834)
STEM		-0.473 (0.345)
# Correct answers		-0.033 (0.062)
# Correct answers*Male		0.055 (0.085)
Treatment1		-1.017* (0.463)
Treatment3		0.190 (0.572)
Male*Treatment1		1.983*** (0.756)
Male*Treatment3		0.367 (0.802)
Constant	neutral	-0.903 (0.745)
Male		1.264 (1.075)
STEM		-0.388 (0.444)
# Correct sums		-0.008 (0.082)
# Correct sums*Male		-0.035 (0.109)
Treatment1		0.554 (0.640)
Treatment3		0.044 (0.871)
Male*Treatment1		0.339 (0.947)
Male*Treatment3		0.561 (1.113)
Observations		309
Log Likelihood		-277.321

Notes: Standard errors in parentheses. ***, **, and * denote significance at $p = 0.01$, 0.05, and 0.10, respectively. The opposite avatar served as the reference category.

We first examine the probability of reporting the real avatar with respect to choosing the opposite avatar. The estimate of *Male* shows no general gender differences in the probability of choosing the avatar that reveals the true gender of the worker. Also, we observe that being in the treatment in which workers know that they will be doing the math task decreases the probability of reporting the real avatar, compared to when workers do not receive any information regarding the task. However, this is not true for the emotions-recognition task. Subjects do not reveal their true gender significantly less in *EIT* than in *MNIT*. Finally, results show that releasing information about the task affects male and female workers differently, depending on the task. While males report their true gender with a higher probability when the task is math-oriented, we observe no gender effect in revealing the worker's true gender in the emotion-recognition task.

We then focus on the likelihood of choosing a neutral avatar. For this case, Table 3 shows that neither the gender of the worker nor the type of task that workers will perform affect the probability of subjects reporting a neutral avatar over the opposite one.

The lack of significance of *# Correct sums* and its interaction with the gender dummy indicates that '*a posteriori'* productivity is not relevant for the avatar decision regardless of the worker's gender. This supports the notion that strategic choice is independent of actual ability; perhaps even females who would perform better expect discrimination and react accordingly.[17]

3.2. Hiring decisions

We now discuss the behavior of the firms. Note that, as a consequence of the endogenous choice of avatars, the distribution of candidates that firms face can differ across sessions. It could happen that particular distributions affect firms' decisions when it comes to hire one worker. Given the limitation of our sample for the different distributions, our results should be seen more as initial evidence than as definitive findings.

We observe that, in *MIT,* the percentage of male and female avatars hired (as a proportion of all hired avatars) is 37.50 and 35.00, respectively. The equivalent figures are 38.09 and 40.47 in *MNIT*, and 38.09 and 50.00 in *EIT*.[18] This result indicates that firms hire a similar proportion of male and female avatars regardless of the treatment. Moreover, the proportion of male and female avatars hired by male and female firms is also not dramatically different. Pooling the numbers data from *MIT* and *MNIT*, we find that the percentage of male avatars and female avatars hired by male firms is 37.50% and 30.00%, respectively. The difference is not

[17] As a robustness test, we find the same lack of significance even when we run the regression only using data from *MIT.* Results are available upon request.

[18] Differences are not statistically significant in any treatment (Z = 0.233, p = 0.816, Z = -0.223, p = 0.823, and Z = -1.099, p = 0.271 for *MIT*, *MNIT*, and *EIT*, respectively, all tests of proportions). The power of the tests is 0.818, 0.825, and 0.401 for *MIT*, *MNIT*, and *EIT*, respectively.

significant (p = 0.478, test of proportions). The respective figures for the percentage of male and female avatars hired by female firms are 38.09% and 45.24% (p = 0.507, test of proportions).

There are also no dramatic differences in hiring decisions in the *EIT*. The percentages of male and female avatars hired are 38.09% and 42.86% when the firm is male and 38.09% and 57.14% when the firm is female. Differences are not statistically significant for either case (p = 0.753 and p = 0.216, test of proportions for male and female firms, respectively). Overall, this analysis indicates that there is no discrimination against female avatars in any treatment.

Result 4: *There is no apparent discrimination against female avatars in either treatment*.

3.3. Workers' performance

This section analyzes workers' performance in the real-effort task. Table 4 shows the mean performance for males and females in each of our treatments.

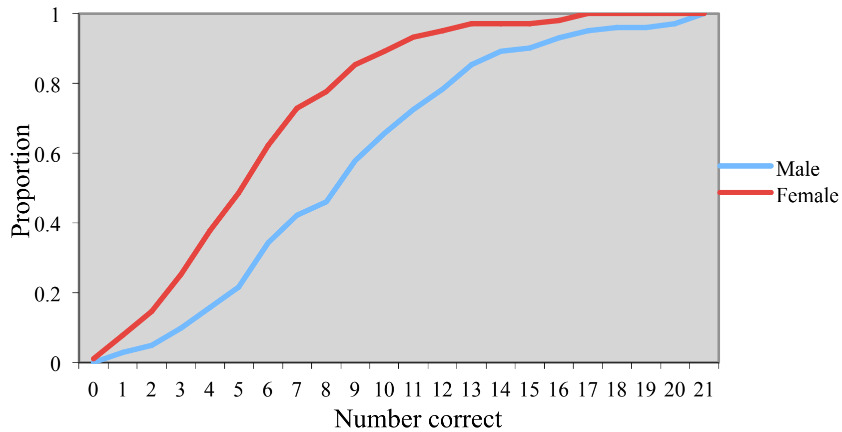
Table 4. Performance by task and gender

	Numbers	*Emotions*
Male	9.059 (0.453)	12.000 (0.296)
Female	6.000 (0.347)	12.019 (0.223)

Note: Standard errors in parentheses.

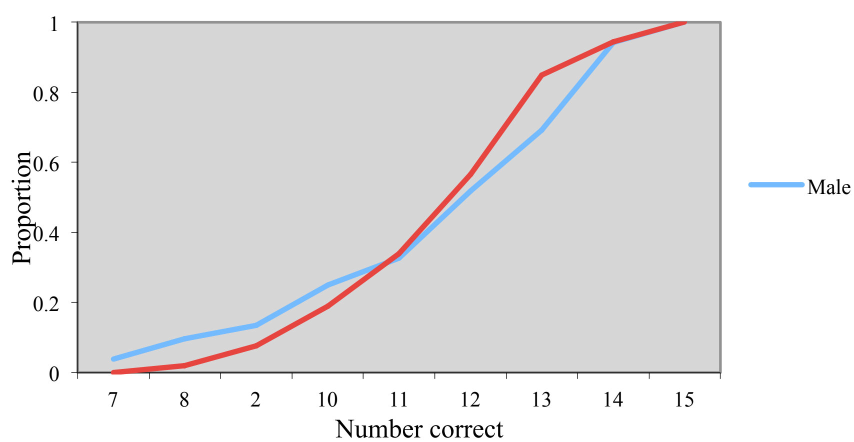
Casual inspection shows that the mean performance is quite different in the numbers task but practically identical with the emotions task. We can also explore the distribution of performance, as shown in Figures 4 and 5. In Figure 4, the Kolmogorov-Smirnov test of cumulative distributions finds a very strong difference in the addition task, $X_2^2 = 20.589$, p = 0.000. We observe clear first-order stochastic dominance. Consistent with some previous results, we do see a significant difference (Z = 3.152, p = 0.002) at the high end of the distribution – 15 of 102 males (14.7%) scored 14 or higher compared to 3 of 103 females (2.9%).

Figure 4: Cumulative distribution of performance in the math task, by gender



In Figure 5, the Kolmogorov-Smirnov test finds no serious difference in the emotions task, $X_2^2 = 2.580$, $p = 0.275$. Recall that the mean of the number correct was essentially identical (12) for males and females on the emotion-recognition task. While the differences in Figure 5 are small, they suggest that there is second-order stochastic dominance for females over males, which is consistent with the smaller variance for males shown in Table 4. Thirty-five women (34.0%) scored within one point of the mean (11, 12, or 13) compared to 23 of the men (22.5%).

Figure 5. Cumulative distribution of performance in the emotions task, by gender.



Result 5: *In the math task, males are more productive than females. There are no gender differences in workers' performance in the emotion-recognition task.*

Our data strongly indicate that there is a gender difference in performance in adding up two-digit numbers. While this conflicts with the prevailing view, with a significance level of $p <$

0.001 our results hardly seem accidental. One potential explanation for our findings is what the psychological literature terms stereotype threat, which basically means that the activation of a specific stereotype may negatively impact the task performance of the negatively-stereotyped group (Steele & Aronson, 1995; Ryan & Ryan, 2005; Günther et al., 2010).

The subjects in the experiment were not unusual and people have not historically been suspicious of results found in a standard subject pool of British students. So, we stand by our result, which is clearly consistent with the stereotype. It seems important for researchers to report (and publish) non-conforming outcomes reached through standard experimental methodology.

Perhaps surprisingly, the nearly-identical performance in the emotion-recognition task is not consistent with the stereotype that women are better at this task. So, hiring female avatars is at least not costly (in expectation) here for the hiring firm. Halladay (2017) finds a similar result with the identical task: Males correctly identify an average of 8.19 emotions, while females correctly identify 8.08 emotions ($p = 0.806$). So, support for this stereotype seems elusive.

4. Conclusion

This paper considers an employment setting with excess workers, where the only information firms have about a worker is the avatar (male, female, or neutral) chosen by that worker. We examine the choice of the avatar in three treatments. The first involves adding two-digit numbers in which the workers know the task before choosing an avatar, while the second also involves adding numbers; however, in the latter case, workers do not know the nature of the task before selecting avatars. The third treatment involves an emotion-recognition task in a setting where the workers also know the task before picking the avatar.

By looking at the avatar choices, we analyze whether workers react to a potential anticipation of discrimination and how this varies across the type of task and the information condition. Results show that males and females workers react differently when they face a situation of potential discrimination. We find that when the task was math-oriented (carrying a male stereotype), most women indeed decided not to reveal their true gender; presumably because they anticipated this would lead to a lower probability of being hired. However, when the task involved emotion recognition, women were much more willing to select an own avatar and did so at the same rate as men. Women also typically chose female avatars when the task was unknown. The difference in the known math-oriented task suggests that women behaved strategically and carefully chose whether to reveal their real gender, depending on the situation.

In the emotion-recognition task, which seems to carry a female stereotype, men were quite prone to choose a male avatar regardless. It could be that males were simply not strategic, but our sense is that this is tied to a reluctance to deny the male identity that is considered to be so useful in society. Evidence from the sociology literature suggests that males could have a higher cost when switching to a non-male avatar, since male identity is associated with power and effectiveness. In Goldberg (1968), articles written by women or men were given to students for evaluation. They find that articles authored by men received higher ratings. Langford and MacKinnon (2000) find that powerful traits stereotyped as characteristic of men tend to be seen as good while powerless traits stereotyped as characteristic of women tend to be seen as bad.

Subjects in Eagly and Wood (1982) judged that men were more influential and women more easily influenced, even when given no information about the individual's roles. Eagly, Wood, and Diekman (2000) find a tendency for the specific roles occupied by men to have more status than the roles occupied by women. Rashotte and Webster test the Ridgeway (1997) view that status beliefs (ideas about competence that are created by gender) arise with mixed-gender interactions and they find significantly higher general expectations for men than for women.

We suspect that giving up their perceived status and privileges would inhibit males from choosing a non-male avatar.[19] Other explanations include overconfidence (Lichtenstein, Fischhoff, and Phillips, 1982; Lundeberg, Fox, and Punccohar, 1994) and differences in emotional reactions to uncertain situations (Croson and Gneezy, 2009; Loewenstein *et al*., 2001). Nevertheless, more research is needed to clearly identify the main forces driving males' behavior. Still, the difference in avatar selection by women across treatments indicates responsiveness to the perceived environment.

Finally, in principle, workers might have believed that their avatar choice was meaningless, despite the fact that their experimental instructions stated that firms were not made aware of the avatar-choice stage. If this were to be the case, we would expect workers to either

[19] Some readers may feel that these stereotypes are outdated. Yet a recent paper (Charness and Rustichini, 2011) finds strong differences across males and females when they play the Prisoner's Dilemma in front of audiences: Men are less cooperative when in front of their peers, while women are more cooperative when in front of their peers. These experiments were conducted in California, arguably the forerunner in the women's movement.

choose their true avatar because of identity considerations, or to randomly choose an avatar. This conclusion does not seem to be supported by our results. We find that 36% of female workers chose female avatars when informed about the fact that the task was math-related prior to choosing the avatar. By contrast, 64% of female workers chose female avatars when not informed about the task to be performed. Thus, many female workers seemed to believe that choosing a female avatar would adversely affect the chance of being hired for a math task, which would rule out the idea that workers considered the avatar to be meaningless.

Regarding performance, we find strong support for the stereotype that men do better on math-related tasks: Men produced 50% more correct sums than women did, and this difference is highly significant. Yet the stereotype that women are better at recognizing emotions received no support in our data, since performance was nearly identical. In fact, we were somewhat surprised by both of these performance results. While there is typically *some* basis for stereotypes, sometimes they manifest in reality and sometimes they do not.

There has been little previous research regarding how men and women make choices when there is a perception that there could be discrimination in hiring. Anticipation of discrimination is critical in terms of employment-related choices by workers and students intending to become workers. Potentially, our results could have interesting implications for policies aiming to reduce the gender gap in STEM careers, suggesting that it may be even more important to dispel the perception that people have about discrimination than to reduce the discrimination in the labor market, since we do not see evidence of the latter in our data.

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Appendix A. Experimental instructions

A1. Instructions for workers. Part one. *Math-Information Treatment*

1. There are two different roles assigned in this experiment. A role can be either worker or firm.

2. Your role is worker.

3. Your task for this part will be the following.

    a. You belong to a group that is composed of five workers (including yourself) and two firms.

    b. There will be a market in which the firms have to decide which worker to hire. Each firm will hire only one worker. That means that in your group there will be three workers that will not be hired.

    c. <u>If the firm hires you</u>, the money you and the firm will make will depend on your performance in the following task. You will be adding a series of five two-digit numbers for five minutes. In this case, the piece rate that you and the firm receive per correct sum is £1.5.

    d. <u>If the firm does not hire you</u>, your payoff will still depend on your performance. However, this time the piece rate you receive is £0.5 per correct sum. You do not generate anything for the firm.

    e. The firms do not know anything about you when they are hiring. The only information they will receive will be an avatar that is representing you. The other workers will be also represented by an avatar on the screen.

    f. Your decision will be to choose how you want to be seen by the firms that are going to hire. So, you will have to decide the avatar that represents you in the market. You will be presented with three options and you have to pick the one you prefer.

4. The firms do NOT know that you yourself chose the avatar that represents you and that the other workers themselves also chose the avatar that represents them.

5. After you and the other workers choose your avatars, the firms will see all the workers that they can hire and will decide who to hire.

6. Once everyone is finished, the experimenter will call you using the number of your computer one by one and pay you privately the amount generated in this experiment.

A2. Instructions for firms. Part one. ***Math-Information Treatment***

1. There are two different roles assigned in this experiment. A role can be either worker or firm.

2. Your role is firm.

3. Your task for this part will be the following.

    a. You belong to a group that is composed of five workers and two firms (including yourself).

    b. There will be a market in which the firms have to decide which worker to hire. Each firm will hire only one worker. That means that in your group there will be three workers that will not be hired.

    c. The money that you make in this experiment depends on the performance of the worker that you hire.

4. In order to hire, you will be shown a table with all the workers that have been randomly assigned to your group.

5. Once the hiring process is over, the worker you hired will perform a task consisting in a series of sums (five numbers of two digits) during five minutes. You will earn £1.5 per correct sum the worker gets.

6. Once everyone is finished, the experimenter will call you using the number of your computer one by one and pay you privately the amount generated in this experiment.

A3. **Instructions for workers who were hired. Part two.** ***Math-Information Treatment***

1. Congratulations, you have been hired by the firm.

2. For this part of this experiment you will perform a series of sums (five numbers of two digits) during five minutes.

3. You will be paid a piece rate of £1.5 per correct sum you get. In the same way, the firm also receives £1.5 per correct sum you do.

A4. **Instructions for workers who were not hired. Part two.** ***Math-Information Treatment***

1. You were not hired by the firm.

2. For this part of this experiment you will perform a series of sums (five numbers of two digits) during five minutes.

3. You will be paid a piece rate of £0.5 per correct sum you get. The firm does not make any money from your performance.

A5. **Instructions for workers. Part one.** ***Math-No-Information Treatment (the instructions for firms and for the second stage of the experiment were the same as in MIT)***

1. There are two different roles assigned in this experiment. A role can be either worker or firm.

2. Your role is worker.

3. Your task for this part will be the following.

    a. You belong to a group that is composed of five workers (including yourself) and two firms.

    b. There will be a market in which the firms have to decide which worker to hire. Each firm will hire only one worker. That means that in your group there will be three workers that will not be hired.

    c. The firms do not know anything about you when they are hiring. The only information they will receive will be an avatar that is representing you. The other workers will be also represented by an avatar on the screen.

    d. Your decision will be to choose how you want to be seen by the firms that are going to hire. So, you will have to decide the avatar that represents you in the market. You will be presented with three options and you have to pick the one you prefer

4. The firms do NOT know that you yourself chose the avatar that represents you and that the other workers themselves also chose the avatar that represents them.

5. After you and the other workers choose your avatars, the firms will see all the workers that they can hire and will decide who to hire.

6. Later, you will participate in a second stage. If you are hired by the firm, you can make three times more money than if you are not hired. We will explain this with more detail later.

7. Once everyone is finished, the experimenter will call you using the number of your computer one by one and pay you privately the amount generated in the experiment.

A6. **Instructions for workers. Part one.** ***Emotions-Information Treatment***

1. There are two different roles assigned in this experiment. A role can be either worker or firm.

2. Your role is worker.

3. Your task for this part will be the following.

    a. You belong to a group that is composed of five workers (including yourself) and two firms.

    b. There will be a market in which the firms have to decide which worker to hire. Each firm will hire only one worker. That means that in your group there will be at least three workers that will not be hired.

    c. <u>If the firm hires you</u>, the money you and the firm will make will depend on your performance in the following task. You will be shown 15 photographs depicting individual's faces. For each image, you will be asked to identify the emotion depicted on the individual's face. The emotions in the images have been professionally classified by psychologists doing research in this field. The images will be projected on your computer screen for a very short period of time (2 seconds). After the image is shown, you will be given four options from which to select the correctly displayed emotion. You will have 20 seconds to submit your answer. You submit an answer by clicking the submit button with your mouse. You and the firm will get £1.5 per emotion you correctly identify.

    d. <u>If the firm does not hire you</u>, your payoff will still depend on your performance. However, this time the piece rate you receive is £0.5 per emotion you identify. You do not generate anything for the firm.

    e. The firms do not know anything about you when they are hiring. The only information they will receive will be an avatar that is representing you. The other workers will be also represented by an avatar on the screen.

    f. Your decision will be to choose how you want to be seen by the firms that are going to hire. So, you will have to decide the avatar that represents you in the market. You will be presented with three options and you have to pick the one you prefer.

4. The firms do NOT know that you yourself chose the avatar that represents you and that the other workers themselves also chose the avatar that represents them.

5. After you and the other workers choose your avatars, the firms will see all the workers that they can hire and will decide who to hire.

6. Once everyone is finished, the experimenter will call you using the number of your computer one by one and pay you privately the amount generated in this experiment.

A7**. Instructions for firms. Part one. *Emotions-Information Treatment***

1. There are two different roles assigned in this experiment. A role can be either worker or firm.

2. Your role is firm.

3. Your task for this part will be the following.

    a. You belong to a group that is composed of five workers and two firms (including yourself).

    b. There will be a market in which the firms have to decide which worker to hire. Each firm will hire only one worker. That means that in your group there will be at least three workers that will not be hired.

    c. The money that you make in this experiment depends on the performance of the worker that you hire.

4. In order to hire, you will be shown a table with all the workers that have been randomly assigned to your group.

5. Once the hiring process is over, the worker you hired will perform the following task: workers are shown 15 photographs depicting individual's faces. For each image, they will be asked to identify the emotion depicted on the individual's face. The emotions in the images have been professionally classified by psychologists doing research in this field. The images will be projected on their computer screen for a very short period of time (2 seconds). After the image is shown, they will be given four options from which to select the correctly displayed emotion. They will have 20 seconds to submit the answer. You will get £1.5 per correct emotion the worker identified.

6. Once everyone is finished, the experimenter will call you using the number of your computer one by one and pay you privately the amount generated in this experiment.

A8. **Instructions for workers who were hired. Part two.** ***Emotions-Information Treatment***

1. Congratulations, you have been hired by the firm.

2. For this part of this experiment you will be shown 15 photographs depicting individual's faces. For each image, you will be asked to identify the emotion depicted on the individual's face. The emotions in the images have been professionally classified by psychologists doing research in this field. The images will be projected on your computer screen for a very short period of time (2 seconds). After the image is shown, you will be given four options from which to select the correctly displayed emotion. You will have 20 seconds to submit your answer.

3. You will be paid a piece rate of £1.5 per correct emotion you get. In the same way, the firm also receives £1.5 per correct emotion.

A9. **Instructions for workers who were not hired. Part two.** ***Emotions-Information Treatment***

1. You were not hired by the firm.

2. For this part of this experiment you will be shown 15 photographs depicting individual's faces. For each image, you will be asked to identify the emotion depicted on the individual's face. The emotions in the images have been professionally classified by psychologists doing research in this field. The images will be projected on your computer screen for a very short period of time (2 seconds). After the image is shown, you will be given four options from which to select the correctly displayed emotion. You will have 20 seconds to submit your answer.

3. You will be paid a piece rate of £0.5 per correct emotion you get. The firm does not make any money from your performance.

A10. **Instructions for the boxes experiment.**

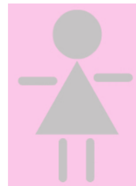
You are now taking part in an economic experiment. Depending on your decisions you will be able to earn money. These instructions describe how you can earn money. Please read them carefully.

The money you will make in this experiment will depend on the performance of somebody else on a different task. The task the other person did is as follows. People were shown 15 photographs depicting individual's faces. For each image, they were asked to identify the emotion depicted on each individual's face. The emotions in the images have been professionally classified by psychologists doing research in this field. The images were projected on the computer screen for a very short period of time (2 seconds). After the image was shown, participants were given four options of emotions from which they selected the option they thought to be correct. They had 20 seconds to submit their answer.

At the front desk of the lab, you will see two boxes. One of the boxes is labeled "males" and the other one is labeled "females". Each box contains 20 slips of paper corresponding to 20 individuals who did the task explained above. Each slip has a number printed on it that corresponds to the number of correct emotions identified by an individual who previously did the task.

Your decision involves choosing the box from which to take out one slip of paper. The number that is printed in your paper will determine your payoff. You will get £0.5 times the number of emotions correctly identified by the person you chose.

Appendix B. Avatar alternatives



Female Avatar

Male Avatar

Neutral Avatar

Appendix C. Stereotype of the emotions task

To test whether the emotions task carries a female stereotype, we conducted an additional experiment with 40 subjects (20 males and 20 females). Similarly to Aguiar *et al* (2009), two different boxes labeled “female” and “male” were placed at the front of a room. Each box contained 20 slips of paper. Each slip was printed with the number of correct emotions identified by the workers in the experiment.[20]

The decision was simply to choose the box from which to select one slip of paper. The number printed in the paper would determine subjects’ payoffs. Participants were paid 0.5 GBP times the number on the slip of paper selected. This was common information. Subjects approached the boxes one by one and made their decision privately. Once the decision was made, they would show the slip of paper to the experimenter and would receive their money. The slip of paper was then put back in the corresponding box.

We find that 85% of the population took the slip of paper from the “female” box, showing that people believe that women are better than men at this task; the binomial test on the entire population gives $p = 0.000$. When we distinguish by gender, results are very similar for males and females. Eighty percent of male ($p = 0.007$) and 90% of female participants ($p = 0.000$) picked the slip of paper from the “female” box.

[20] The 40 workers reported in the slips of paper were randomly selected from the entire subject pool that had participated in the main experiment.