Attractive Supervisors: How Does the Gender of the Supervisor Influence the Performance of the Supervisees?

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ABSTRACT AND KEYWORDS	
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Free Keywords	supervision, mixed-sex interaction, performance
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Attractive supervisors: How does the gender of the supervisor influence the performance of the supervisees?

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Abstract

A series of field and laboratory experiments were conducted in which single-sex groups of male or female students competed in different intellectual tasks to earn money or university grades (N = 291). The supervisor of these groups was one of several young and attractive males or females. The results show that when the supervisor was a female, the performance of male participants was, on average, negatively influenced. Group size moderated this effect such that having a female supervisor produced a negative effect in small groups and a positive effect in large groups of male supervisees.

Keywords: Supervision, mixed-sex interaction, performance

JEL codes: M54, J01, D03

PsycINFO codes: 2340, 2970, 3620

1. Introduction

Imagine a company that wants to hire the best possible new employees. The company uses an assessment center (Gaugler, Rosenhal, Thornton, & Bentson, 1987; Klimoski & Brickner, 1987) to achieve this objective. The applicants are typically male university graduates, and the company employs two human resource managers who typically supervise and evaluate the applicants in the assessment center. One of the human resource managers is a young woman; the other one is a young man. Both managers are very good at their jobs and happen to be physically attractive. Will the performance of the applicants be different if the assessment center is lead by the woman rather than the man? Could this lead to a biased evaluation of the candidates and a suboptimal hiring decision?

Given the high practical relevance of these questions, it is surprising how little we know about mixed-sex supervision and its influence on the intellectual performance of the supervisees.

In this study, we focus on a situation in which participants compete in an intellectual task, and the supervisor of the task is young and physically attractive, therefore stimulating mating desires in a mixed-sex situation. From a theoretical perspective, it is unclear how this type of supervision influences the intellectual performance of the supervisees. On the one hand, individuals may want to impress their supervisor and potential mate by their intellectual performance because intelligence is a highly preferred characteristic in sexual partners (Bruch, Gorsky, Collins, & Berger, 1989; Miller, 2001). A mating preference for intelligent partners would suggest that mixed-sex supervision has a positive effect on intellectual performance. On the other hand, it may be that leaving a favorable impression on the opposite sex (i.e., impression management) consumes a substantial amount of cognitive resources and energy (Karremans, Verwijmeren, Pronk, & Reistma, 2009; Vohs, Baumeister, & Ciarocco, 2005), thereby distracting individuals from the completion of intellectual tasks.

In this case, the predicted effect of mixed-sex supervision on intellectual performance would be negative.

Prior research has shown that beauty and gender can have significant effects on earnings in the labor market (Hamermesh & Biddle, 1994) and on cooperation in public goods experiments (Andreoni & Petrie, 2008). Furthermore, mixed-sex interactions influence human behavior and points to significant differences between men and women in this respect. For example, research on risk behavior in mixed-sex situations has shown that men are more likely to make use of high-risk chess strategies when they play against women as opposed to a situation in which they play against men (Gerdes & Gränsmark, 2010). In a field experiment involving young, male skateboarders, Ronay and von Hippel (2010) found that physical risk taking (measured by the number of crash landings) increased when female observers were present. McAlvanah (2009) finds that both men and women are more likely to be risk-taking after having seen pictures of opposite sex faces. Furthermore, Wilson and Daly (2004) reported that men became more impatient (i.e., they applied higher rates to discount future payments) after having seen a photo of an attractive woman. Similarly, having seen the photo of a smiling female in the corner of an offer letter increased the probability of accepting the offer significantly in a large field experiment (Bertrand et al. 2007).

Men generally seem more likely than women to perceive mixed-sex interactions as mating games and are therefore more likely to engage in efforts to impress the opposite-sex interaction partner (Griskevicius, Cialdini, & Kenrick, 2006; Griskevicius, Tyunur, Sundie, Cialdini, Miller, & Kenrick, 2007). Do these findings carry over to intellectual performance? If so, would the effects of mixed-sex supervision be positive or negative?

To analyze these research questions, we conducted several incentive-compatible (Smith, 1982) experiments in the laboratory and in the field (Harrison & List, 2004) in which single-sex groups of male or female students competed in different intellectual tasks.

Incentive compatibility in our experiments means that all participants had clear, well-understood incentives to perform as best as they could in the intellectual tasks we gave them; we used either money or university grades as motivation for good performance. The supervisors in our experiments were young, attractive strangers. In the treatment (control) group, the supervisor was of the opposite (same) sex. The supervisees and the participants were assigned randomly to either control or treatment groups.

Our study is the first to examine the influence of mixed-sex interaction on intellectual performance in a formal supervision setting in which the supervisor provides the participants in the experiment with feedback about their intellectual performance. Furthermore, our study is unique in investigating this topic in a set-up that measures intellectual performance in a competitive situation resembling real world situations, such as those that occur at assessment centers or during exams in schools and universities. As robustness checks, our experimental design deliberately makes use of different male and female supervisors, varies group size and intellectual tasks, uses both artificial laboratory and naturally occurring experimental situations in the field, and employs real incentives for participants to perform well in the intellectual task.

The remainder of this article is organized as follows. The next section describes the experimental designs. The section that follows presents the empirical analyses. The final section discusses our results in light of existing literature, derives practical implications, and concludes.

2. Methods

We conducted three experiments with different participants. We carried out two of the experiments in a laboratory in which participants solved Sudoku puzzles (hereafter referred to as Sudoku experiments). The third experiment was a field study in the form of a multiple-

choice practice exam at a university (hereafter referred to as exam experiment). The number of participants in each experiment is reported in Table 1.

All sessions consisted of either young male or female participants, who were randomly allocated to either the control or the treatment groups. All participants except one were students. The mean age of participants was 22 years, ranging between 17 years and 38 years. In the treatment groups, the supervisor of the experiment was an attractive, young person of the opposite sex. For example, the male treatment groups had an attractive female supervisor. In the control groups, the supervisor was an attractive young person of the same sex. Hence, the control groups were single-sex environments, while the treatment groups created a mixed-sex environment through the supervisor. Overall, six supervisors were involved in the experiments, and all of them were graduate or undergraduate students who were unacquainted with the participants. Overall, there were 291 participants, and 55% of them were men.

>> Table 1 about here <<

We measured intellectual performance with one of two different tasks. We asked the participants to either complete two Sudoku puzzles as fast as possible or to participate in a multiple-choice practice exam in a graduate level course in Economics. Sudokus are logic-based, combinatorial number-placement puzzles. The Sudokus we selected for the experiment are a relatively simple intellectual task that, when given a short introduction, does not require any additional previous knowledge. In addition, experiments using Sudoku puzzles offer a natural, self-controlling mechanism because the person solving them can check them easily for correctness. The performance of each subject can be measured by the time needed for completion. Undoubtedly, multiple-choice exams are a standard way to measure intellectual performance in schools, universities, and in standardized tests, such as the GRE or GMAT. In contrast to solving Sudoku puzzles, however, success in such exams requires previous

learning efforts and specialized knowledge. The students who participated in the exam experiment knew about this condition because the exam was part of a course in which they had enrolled earlier.

The experiments were carried out in a large public European university. The first round of Sudoku experiments was conducted in June 2009. The experiments were then repeated with different participants and different supervisors in February 2010 to determine if the preliminary results obtained in the first round of experiments would replicate in a larger sample and with different supervisors. The supervisors of the second series of Sudoku experiments were also supervisors in the exam experiment in October 2009. Hence, potential differences between the second round of Sudoku experiments and the exam experiment could be due to the type of the intellectual exercise, but not due to different supervisors. In every session, the supervisors adhered strictly to a detailed time and task schedule to reduce a potential influence that may result from different behaviors across treatments. Moreover, the supervisors were told to behave in a friendly but professionally distant manner toward the participants. The supervisors evaluated the intellectual performance of the participants in all experimental conditions and provided everyone with individual feedback about their performance. We informed all the participants of this condition before beginning the experiments.

The number of participants varied between sessions. In the first set of Sudoku experiments in June 2009, the number of participants per session varied between 3 and 6 (mean 4.5). In the second set of Sudoku experiments in February 2010, we also investigated larger groups, and the number of participants per session varied between 2 and 12 (mean 6.7). We introduced the variation in group size to test if the effect of the treatment on intellectual performance depended on the number of competitors participants faced. In the exam

experiment, the number of participants per group was derived externally from the number of male and female students who had enrolled in the course.

All experiments were incentive-compatible, meaning that better intellectual performance was always rewarded, the rewards were substantial, and the incentive structures were explained clearly at the beginning of the experiments. All participants understood that better intellectual performance would increase their rewards.

In the Sudoku experiments, participants received money as a reward for good performance. In addition to an attendance fee of five Euros given to everyone, the participant solving the Sudoku experiment fastest in a session earned an additional five Euros, while relatively slower participants received correspondingly lower payoffs. The slowest participant in every session did not receive any additional payment. Accordingly, the last participant usually stopped solving the Sudoku experiment once the second last participant to finish gave a signal. Typically, we obtained n - 1 results per experimental session. The financial rewards were scaled proportionately by group size such that the group size did not influence the money that participants could earn, given their specific percentile rank of performance. Hence, the incentives for intellectual performance in the experiments were independent from group size.

We recruited participants for the Sudoku experiments by advertising the experiment at the university through flyers, posters, word of mouth and class announcements in an undergraduate course in economics. We did not communicate the purpose and content of the experiment to any potential subject prior to the sessions, and we announced the experiment neutrally as an "economic experiment." Participants who were interested registered online and selected a timeslot for participation. We conducted 48 experimental sessions overall. We scheduled every session for one hour. On average, participants needed less than 30 minutes to complete all tasks and collect their payment.

In the exam experiment, participants could receive bonus points for the course in which they had enrolled. Every participant in the course could earn up to 100 points in the regular final exam of the course. In addition, depending on the number of correct multiple-choice responses they provided, students who participated in the experimental practice exam could earn up to 10 extra points that would be added to their final grade. The course and the exam were relatively difficult for students such that no student received more than 90 points in the final exam. For most students, the course was required for their Masters of Economics degree program. Students anticipated that the exam would be difficult and saw the practice exam as a welcome opportunity to improve their final results. Almost all students who participated in the final exam also participated in the practice exam and the experiment.

In the exam experiment, the grades that the participants could receive did not depend on the size of the group. Therefore, performance differences between groups of different sizes cannot be explained by different incentives for intellectual performance in any of the experiments we conducted (neither Sudoku experiments nor exam experiments).

We conducted the different experimental treatments in separate rooms. In the Sudoku experiments, all participants met in a registration room at the beginning of their session. Upon arrival, the participants were welcomed in the preparation room by a student assistant and randomly assigned to either the treatment or the control group by drawing lots. Subsequently, a student assistant accompanied the group to one of the experimental rooms. The experimental environment and the experimental procedure were exactly the same for all sessions. We began the actual experimental phase by asking the supervisor to read the instructions out loud while the participants read along in their own copies. Afterwards, the instructor gave them three minutes to read through the instructions on how to solve a Sudoku puzzle. Once this time expired, the instructor gave the participants the signal that allowed them to open the Sudoku envelopes and start solving them. Participants were asked to raise a

red card upon solving their Sudoku puzzles. The instructor monitored each participant's time with a digital watch. While gathering the Sudoku puzzles to check for correctness, the instructor handed out a questionnaire. The instructor then asked the participants to complete the questionnaire and to put it inside an envelope, seal it, and then hand it back to the supervisor. Finally, the participants were sent back to the preparation room with a voucher to receive their payments. They acknowledged receipt of their payments in the preparation room.

In the exam experiment, we formed four groups a few days before the practice exam took place using the last name of students as a randomization device to split them into equally sized control and treatment groups, one each for men and for women. We conducted the four resulting sessions at the same time in four different rooms at the university, and one day prior to the exam via email, the students were informed of which room they should show up for the practice exam. Identical to the Sudoku experiments, the exam experiment started with the supervisor reading out the instructions. Students had two envelopes on their table: a large envelope that contained the practice exam and a small envelope that contained a questionnaire. After the supervisor read out the instructions, students opened the practice exam and had two hours of time to complete the exam. All students finished within two hours, and the time needed to complete the exam did not influence their grades. The students put completed exams back into the large envelope, and the supervisor picked them up.

Students then had the choice to also complete the questionnaire in the small envelope. They were not required to fill out the questionnaire, but if they did, they earned five Euros in addition to the course credit, and their responses and exam result would be included in this study. All students decided to complete the questionnaire and opted for participating in the experiment. When everyone was finished, the supervisor collected both envelopes from all participants and asked them to wait outside for their exam results. The supervisor then graded

all exams and informed all students individually about their results. The supervisor explained this procedure as part of the instructions read out loud before the exam started.

In the additional questionnaires that were collected, participants were asked about their age, educational background, relationship status, working status, previous experience with the intellectual task, and several opinion statements, including their motivation for the experiment and whether they found themselves physically attractive, intelligent and diligent. The exam and the second set of Sudoku experiments also included a short measure of personality (Gosling, Rentfrow, & Swann, 2003). We used all these additional variables for randomization control across treatments by computing a matrix of bivariate correlation coefficients between all available variables. Only the variable occupational status correlated significantly with both intellectual performance (r = -0.13, p = 0.03) and with the treatment dummy (r = 0.14, p = 0.02). However, adding this variable to the multivariate regressions reported below did not influence the results in a substantial way.

In addition, we included questions about whether the participants viewed the experimental supervisor as attractive and whether they would go out with the supervisor on a romantic date if asked. Participants understood that the supervisor would never see their responses to the questionnaire, that the questionnaire was anonymous, and that the questionnaires were only linked back to the experimental performance much later not by the supervisors but by researchers by means of the participant's number for the experiments (not by their names or student IDs). The experimental instructions and questionnaires are included in the Appendix of this paper.

To compare the results across the three experiments and to pool observations for statistical analyses, we transformed the time needed to solve the Sudoku puzzles and the number of mistakes or unanswered questions in the multiple choice exam (out of 15) into *z*-scores using

$$z = \begin{cases} z_s = -\dfrac{X_i - \mu_s}{\sigma_s} \; if \; i \in s \\ z_e = -\dfrac{X_i - \mu_e}{\sigma_e} \; if \; i \in e \end{cases},$$

where *i* is the subject (*i* = 1,...,*N*), *s* stands for the Sudoku experiments, *e* stands for the exam experiment, μ is the sample mean, and σ is the standard deviation of the sample. Participants who made mistakes in solving the Sudoku puzzle or who finished last in their group are excluded from the computation of the *z*-scores and all further analyses. *Z*-scores have, by construction, a mean value of zero and a standard deviation of one. To ease the interpretation of the statistical results, we adjusted the sign of *z* in the formula above such that a high *z*-score corresponds to a high rank in intellectual performance compared to others in the sample and vice versa. A *z*-score of zero implies an average performance. The best and the worst performer in our experiments have *z*-scores of 2.68 and -4.59, respectively. The median performance was 0.26, which implies a slight negatively skewed performance distribution (*skewness* = -1.37), which results from a few participants who spent a disproportionately long time solving the Sudoku puzzles.

3. Results

In summary, our analyses show that the effects of mixed-sex interaction on intellectual performance were different for men and women and that the effects were moderated by the size of the group in which the participants competed against each other. Men demonstrated better intellectual performance in small groups compared with large groups. In small groups, the presence of a female supervisor had strong, negative effects on the intellectual performance of male supervisees. In large groups of men, however, the presence of a female supervisor reduced the negative effects of group size and increased average intellectual

performance. These effects were particularly strong for groups supervised by a particularly attractive female (a semi-professional model). For women, the effects of having a male supervisor were weaker and often insignificant.

Table 2 reports the results of OLS regressions on intellectual performance. The results show significant treatment effects for men (p = 0.07) and insignificant effects for both women (p = 0.86) and the pooled samples of men and women together (p = 0.23). When they were supervised by an attractive female, the intellectual performance of men was 0.31 standard deviations worse on average.

>> Table 2 about here <<

Tables 3 and 4 report the results of OLS regressions investigating whether these main effects hold for all supervisors of the opposite gender, regardless of group size. For this purpose, in the regression, we control for the identity of opposite sex supervisors instead of using a dummy variable for the treatment groups. We also estimate this model separately for participants in small groups and large groups. A Chow-test (Chow 1960; Gujarati 1970) reveals that the effects of the experimental treatment are significantly different for men and women in small groups (p = 0.03).

Table 3 shows the results for male participants. The performance decreasing effect only occurs for one of the two female supervisors and only in small groups. Although all supervisors were young, physically attractive and well dressed, the female who caused the negative effect in small groups happened to be a semi-professional model who had performed in various fashion shootings and shows. This female supervisor was perceived as even more

attractive than the others.[1] In large groups, if observations from the exam and the Sudoku experiment are analyzed jointly ($p_{female1} = 0.48$ and $p_{female2} = 0.21$), then being supervised by a female has a non-significant, performance increasing effect on men.

A comparison of the constants in the regressions for small and large groups shows that, after controlling for the supervisor and the exact number of group members, intellectual performance was significantly below average in large groups and above average in small groups. This finding is peculiar because the incentives to perform well in the experiment were held constant for each percentile of the performance distribution (see payoff tables of the experimental instructions in the Appendix).

A possible explanation for this finding is that men may attach value to being the winner or top performer in a competition (Gneezy, Niederle, & Rustichini, 2003; Gneezy & Rustichini, 2004). The satisfaction of winning a competition may provide additional pride and motivation to perform well that go beyond the direct incentives for top performance induced by the experimental design. The chances to come out on top obviously decrease with the number of competitors. Hence, men in larger groups may lack the additional motivation of trying to perform well for the sake of winning, which may decrease the average performance in larger groups. In this situation, our results show that being supervised by an attractive female can restore some of the motivation to perform well. This effect is expected to be particularly strong if the incentives for good performance are otherwise relatively low, such as in the Sudoku experiment.

>> Table 3 about here <<

[1] Out of all supervisors, this female supervisor scored the highest among subjects in the question "I find the supervisor of this experiment is good looking".

To investigate this possible interaction effect between group size and supervision by a female in a low incentive situation, Figure 1 focuses on the intellectual performance of men in the second Sudoku experiment. In this experiment, female 1, the model, supervised all male participants in the experimental treatment group. Furthermore, we varied the group size systematically so that the effect of female 1 on the performance of men in groups of very different sizes could be compared directly.

The significant interaction effect between treatment and group size displayed in Figure 1 suggests that the negative effects of being in a large group on performance are compensated for if the female model supervises men. Apparently, the presence of a very attractive potential mate has a disciplining effect on men in large groups that impedes them from a lackadaisical performance to some extent. On the other hand, Figure 1 also illustrates the negative effect of having an attractive female supervisor in small groups.

>> Figure 1 about here <<

Finally, Table 4 reports the results for women. In the pooled regression, none of the male supervisors had a significant influence on the intellectual performance of female participants. In small groups of female participants, male 2 had a slightly performance decreasing effect. Male 2 received slightly higher attractiveness ratings from the female participants than male 1[2]. This result corresponds to our findings for male participants in Table 3, although the effect size for female participants is considerably smaller. In contrast to the results for male participants, for the females in large groups who were supervised by a

[2] Based on the question "I find the supervisor of this experiment good looking".

man, we did not find evidence for a performance increasing effect. Only the most attractive female and male supervisors had significant effects on the performance of supervisees of the opposite gender, suggesting that this gender effect is indeed driven by perceived physical attractiveness and mating desires.

>> Table 4 about here <<

We estimated a variety of alternative model specifications to test the robustness of our main results. The qualitative results of the regressions did not change when we included self-reported measures of how attractive the supervisor was perceived, romantic intensions of participants towards the supervisor or the type of intellectual task (exam or Sudoku). If we analyze the original performance measure (seconds needed to solve the Sudoku experiments) instead of *z*-scores, we obtain similar results, although some of the coefficients become insignificant due to the smaller sample size.

4. Discussion

Research has shown that the exposure of men to attractive women can lead men to demonstrate their own mating value to the women (Griskevicius et al., 2007; Janssens, Pandelaere, van den Bergh, Millet, Lens, & Roe, 2011; Sundie, Kenrick, Griskevicius, Tybur, vohs, & Beal, 2011). One way of doing so would be by performing well in the test and beating the competitors, which demonstrates one's intellectual ability. If this is the case, the presence of the attractive potential mate should motivate men, along with monetary or grade incentives, to perform well in the test, and should also have a positive impact on intellectual performance.

However, there are also other ways to impress potential mates by appealing to common mating preferences, such as displaying humor, high social status in the group, or sympathy (Buunk, Dijkstra, Fetchenbauer, & Kenrick, 2002; Buss & Barnes, 1986; Buss, 1988;

Feingold, 1992; Fisman, Iyengar, Kamenica, & Simonson, 2006; Townsend, 1989). The above strategies would influence performance negatively in the intellectual task at hand because such activities exhaust the limited amount of cognitive resources people have available (Karremans et al., 2009). This negative effect is similar to the negative effect that noise pollution has on intellectual performance as a result of people's attempts to cope with the distraction (Weinstein, 1974, 1977). If participants have the conscious or unconscious desire to increase their mating chances, they face a trade-off between different conflicting strategies to achieve this goal.

Furthermore, a distraction may also occur even if the participants do not consciously or unconsciously try to impress the attractive potential mate and simply gaze at the supervisor instead of focusing on the test. In the language of Economics, such gazing is similar to consumption in that it raises individual utility and enjoyment. Again, there is a clear trade-off between engaging in such consumption by just enjoying the sight for a moment and the investment into increasing mating chances by performing well on the test. If this decision is made consciously, one would expect to see more "investment" in small groups and more "consumption" in large groups because the expected returns to investing would be lower in large groups due to greater competition from other potential mates. However, our empirical results in Table 3 and Figure 1 are not consistent with that interpretation. Instead, we observe the opposite: under female supervision, men perform better in large groups than in small groups. One possible explanation is that men take the number of competitors into account and adjust their impression management strategies to impress the female supervisor. In small groups, it is easier for men to be noticed by the supervisor, to establish eye contact, and to display desirable attributes that would increase their mating chances such as humor, social status, or kindness. In large groups, it becomes more difficult to be noticed personally for characteristics other than intellectual performance, on which participants received personal

feedback from the supervisor. It is possible that men tried to play to their "natural strengths" in small groups at the expense of their intellectual performance but recognized that good performance was their only way to get attention in large groups.

Overall, the men in our experiment were more strongly affected in their intellectual performance by the experimental treatment than women, which is in line with the findings of prior studies (Griskevicius et al., 2007; Janssens et al., 2011; Karremans et al., 2009; Sundie et al., 2011). There are several possible explanations for this finding. First, it is possible that men have stronger desires to attract a potential mate and therefore react stronger to the presence of mating cues. Second, the possible interaction between participants and supervisors in the experiment was very limited and therefore put a greater weight on the physical attractiveness of the supervisor as a potential trigger of mating desires. This situation made it more likely that men would respond to the experimental treatment because men generally put greater emphasis on physical attractiveness of their potential mates than women do (Buunk et al., 2002; Fisman et al., 2006; Townsend, 1989). Third, it is possible that the supervisors from the opposite sex were perceived as more attractive by the male participants than by the female participants. Beauty is in the eyes of the beholder, and perhaps the (male) experimenters were more successful in anticipating the male participants' preferences when they recruited the supervisors for this study. Regardless, the physical attractiveness ratings that male 2 (3.5) and female 1 (3.8) received from the supervisees of the opposite sex did not differ significantly. Nevertheless, the result that men react more strongly to mating cues than women do should not be generalized.

Our experimental design and results do not relate directly to research investigating the influence of gender diversity on performance of teams (van Knippenberg, Dreu, & Homan, 2004, Ivanova-Stenzel & Kübler 2011). We studied a situation in which participants competed against each other in a test situation (that is not repeated) that does not allow for

any interaction between participants during the test. Team performance, on the other hand, usually requires extensive collaboration over a longer time period with the joint goal of maximizing the performance of the team rather than being in direct competition with other team members. Furthermore, the gender diversity in our study is limited to the gender of the supervisor of a group of participants of the same sex; in group performance studies, there is usually no supervisor, and diversity refers to the entire group of participants. In contrast to our study, research on team performance often finds a positive effect of gender diversity (Hoogendoorn, Oosterbeck, & van Praag, 2011; Wegge, Roth, Neubach, Schmidt, & Kanfer, 2008) and suggests that the influence of gender diversity on team performance is moderated by the incentive scheme (Ivanova-Stenzel and Kübler, 2011), the elaboration of task-relevant information in multiple interactions among team members (van Knippenberg et al., 2004) and the type of conflicts that emerge over time (Pelled, Eisenhardt, & Xin, 1999). In our study, participants could not elaborate on task-relevant information with others, and there was no scope for conflicts or conflict management.

Our findings have important practical implications. In real life, people often face test situations similar to those found in our experiment, and often these test situations, such as exams at the university or participation in assessment centers, have far-reaching consequences (Gaugler et al., 1987; Klimoski & Brickner, 1987). Our results suggest that presenting participants with an attractive supervisor of the opposite sex can bias measures of cognitive performance to the disadvantage of some participants and the organizations that are trying to measure the intellectual aptitude of their applicants accurately. The moderating effect of group size implies that the presence of an attractive female supervisor can have a disciplining effect on large groups of men competing against each other in a cognitive task. Because being in a large group can reduce motivation (Jones, 1984), the presence of a potential mate can help to restore motivation to perform well in large groups. This seems

particularly relevant in situations in which the stakes are not high such that being in large groups would indeed reduce the motivation of men to perform well. Some examples include training situations in firms or occasional tests in schools and universities that do not have a large influence on final evaluations.

In conclusion, we found that the gender of the supervisor and group size are important moderator variables for the intellectual performance of supervisees.

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Tables

Table 1: Number of participants across experiments

	Men			*Women*			
	Sudoku 1	*Sudoku 2**	*Exam**	*Sudoku 1*	*Sudoku 2**	*Exam**	*Total*
Control	26	29	27	33	17	14	146
Treatment	30	28	19	31	28	9	145
Total	56	57	46	64	45	23	291
Note: * indicates that the same supervisors conducted the experiment.							

Table 2: The effect if mixed-sex interaction on intellectual performance

	Pooled sample		*Men only*		*Women only*	
	Coeff.	*Std. Err.*	*Coeff.*	*Std. Err.*	*Coeff.*	*Std. Err.*
Treatment	-0.16	(0.13)	-0.31*	(0.17)	0.04	(0.20)
Constant	0.08	(0.10)	0.13	(0.12)	0.01	(0.14)
Model Diagnostics						
N	232		132		100	
Prob > F	0.23		0.08		0.86	
R^2	0.01		0.02		0.00	

Notes: The table shows OLS regressions on *z*-scores of relative performance.
*** denotes 0.01 significance level.
** denotes 0.05 significance level.
* denotes 0.1 significance level.
Observations relating to subjects who had mistakes in the Sudoku are excluded.

Table 3: The effect of female supervision on male intellectual performance: group size as a moderator

	Men		*Men, groups of less than 6*		*Men, groups of more than 5*	
	Coeff.	*Std. Err.*	*Coeff.*	*Std. Err.*	*Coeff.*	*Std. Err.*
Female 1	-0.45**	(0.19)	-1.61***	(0.37)	0.17	(0.24)
Female 2	0.00	(0.26)	-0.30	(0.28)	0.65	(0.51)
Group size	0.00	(0.01)	-0.29	(0.19)	0.03	(0.02)
Constant	0.10	(0.19)	1.63**	(0.79)	-0.81**	(0.36)
Model Diagnostics						
N	132		52		80	
Prob > F	0.11		0.00		0.19	
R^2	0.04		0.30		0.06	

Notes: The table shows OLS regressions on *z*-scores of relative performance.
*** denotes 0.01 significance level.
** denotes 0.05 significance level.
* denotes 0.1 significance level.
Observations relating to subjects who had mistakes in the Sudoku are excluded.

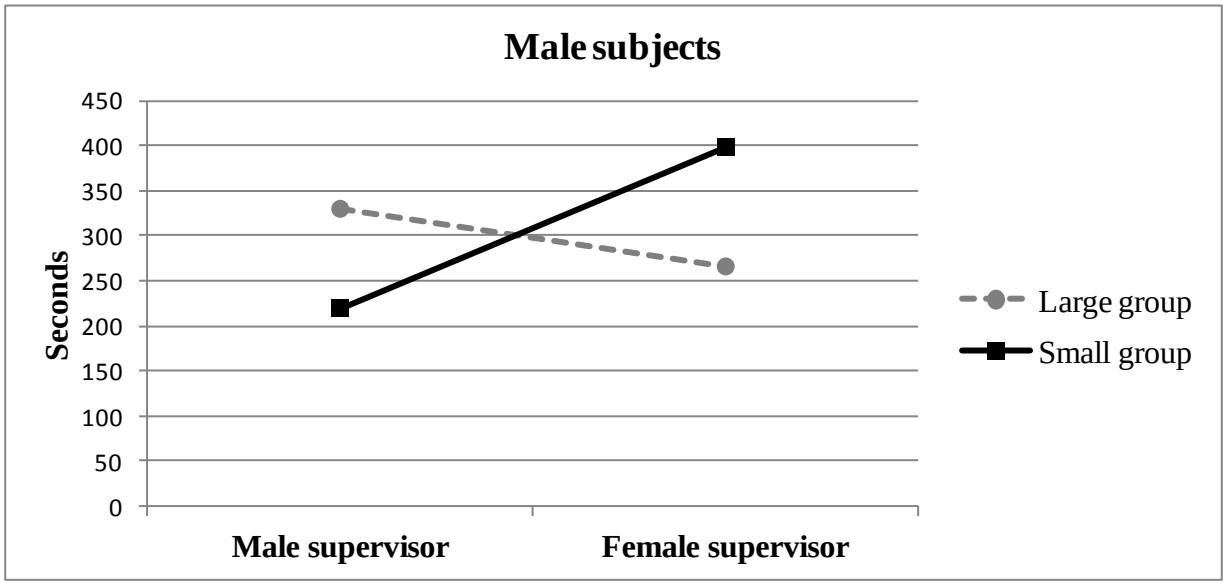
Table 4: The effect of male supervision on female intellectual performance: group size as a moderator

	Women		*Women, groups of less than 6*		*Women, groups of more than 5*	
	Coeff.	*Std. Err.*	*Coeff.*	*Std. Err.*	*Coeff.*	*Std. Err.*
Male 1	0.57	(0.49)	0.49	(0.39)	-	-
Male 2	-0.22	(0.25)	-0.54*	(0.34)	-0.04	(0.37)
Male 3	0.31	(0.29)	0.18	(0.25)	0.57	(0.82)
Group size	0.02	(0.03)	0.06	(0.16)	0.04	(0.06)
Constant	-0.17	(0.27)	-0.21	(0.68)	-0.48	(0.75)
Model Diagnostics						
N	100		52		48	
Prob > F	0.46		0.22		0.87	
R^2	0.04		0.11		0.02	

Notes: The table shows OLS regressions on *z*-scores of relative performance.
*** denotes 0.01 significance level.
** denotes 0.05 significance level.
* denotes 0.1 significance level.
Observations relating to subjects who had mistakes in the Sudoku are excluded.

Figures

Figure 1: Experiment 3 – The moderating effect of group size in the relationship between female supervision and male intellectual performance



Notes: Small groups have 2 to 6 participants, large groups have 7 to 12 participants. Means are significantly different between control and treatment groups for small (t = -2.72) and large groups (t = 1.97). Female 1 was the only female supervisor in experiment 3.

Online Appendix

A1 - Experimental instructions - Sudokus

Thank you for agreeing to participate in today's experiment. At the end of the session you will be paid in cash for your participation.

All participants of the experiment will receive a show-up reward of €5. Different participants may earn an additional amount of money, ranging from €1 to €5 depending on the number of participants per experiment and their achievement during the experiment. Although there are at most 12 people participating in the experiment, everyone is working independently. This means that your earnings are based entirely on your performance relative to the performance of the other participants. Do not talk or in any way communicate with other participants from now on. Do not open the envelope in front of you yet. Please turn off your cell phones. If you have a problem at any point in the experiment, please raise your hand.

In the envelope in front of you, you will find two Sudokus that you have to solve once the experiment has started. The time you need to solve the Sudokus will be measured. Once you have completed both sudokus, raise the red card lying on your table. To guarantee the comparability of all experimental sessions, questions concerning how to solve the Sudokus will not be answered at any point of the experiment. Please remain seated and remain quite when you are finished.

When everyone is finished, the supervisor will collect your Sudokus to check them for correctness and ask you to complete a short anonymous questionnaire. After this, you will receive a voucher that you can cash in at the registration room after the session. Please remain seated and quite until all participants are finished and the supervisor gives a sign that you are allowed to leave the room.
You will be paid according to your performance in solving the Sudokus relative to the other participants.

Small group sessions

Ranking / Participants	**1.**	**2.**	**3.**	**4.**	**5.**	**6.**
3	5 €	3 €	0 €			
4	5 €	3.5 €	2 €	0 €		
5	5 €	3.5 €	2.5 €	1.5 €	0 €	
6	5 €	4 €	3 €	2 €	1 €	0 €

Large group sessions

Rank / Participants	**1.**	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**9.**	**10.**	**11.**	**12.**
6	5 €	4 €	3 €	2 €	1 €							
7	5 €	4 €	3.5 €	3 €	2 €	1 €						
8	5 €	4 €	3.5 €	3 €	2 €	1.5 €	1 €					
9	5 €	4.5 €	4 €	3.5 €	3 €	2.5 €	2 €	1 €				
10	5 €	4.5 €	4 €	3.5 €	3 €	2.5 €	2 €	1.5 €	1 €			
11	5 €	4.5 €	4 €	3.5 €	3 €	2.5 €	2 €	1.5 €	1 €	0.5 €		
12	5 €	4.5 €	4 €	3.5 €	3 €	2.5 €	2 €	1.5 €	1 €	0.5 €	0.5 €	

On your table you will find:

- One envelope with a sheet showing two different Sudokus to be solved during the experiment. Once the experiment starts you are allowed to open the envelope.
- One pencil
- One rubber
- One red card
- One instruction sheet how to solve a Sudoku

Please check if all mentioned items are provided.

Now you have 3 minutes to read the instruction how to solve a Sudoku on the other side of this sheet. The instructor will give a sign when the experiment starts and you are allowed to open the envelope.

GOOD LUCK!

How to play Sudoku

The Sudoku grid consists of thirty-six squares in a six by six grid. To solve the Sudoku, each square in the grid must contain a number between one and six, with the following conditions:

- Each row of six cells must contain each of the numbers from 1 to 6 once and only once.
- Each column of six cells must contain each of the numbers from 1 to 6 once and only once.
- Each of the six 3 by 2 boxes of six cells must contain each of the numbers from 1 to 6 once and only once.

The Sudoku starts with a partially filled grid and you must complete the grid while following the rules above. If you complete the grid, you've solved the Sudoku.

2	1	6	3	4	
5	3	4		6	1
1	4	3	5	2	
6	2	5	1	3	4
	5	2	6	1	3
	6	1	4		2

	4		6		2
	1				
4	2	6	5		1
5		1	4	2	6
				4	
2		4		6	

2		1	3		
4		3			2
5			2	3	
	2	4			1
6			1		3
		2	4		6

A2 - Experimental instructions - Exam

Welcome to the practice exam in ‚Economics of Entrepreneurship'.

From now on, please be completely silent and refrain from any sort of verbal or non-verbal communication with others. Please also switch off your mobile phones if you have not already done so. No books, notes or other materials are allowed during the exam. We will not count your practice exam and you will not receive bonus points if you do not comply with these rules.

There are two envelopes in front of you. Do not open them before I tell you to do so.

The large envelope contains the practice exam. The practice exam consists of 15 multiple choice questions with four answers to each question. Only one of the answers is completely correct. You can earn up to 5 bonus points if you answer all questions correctly. When you are finished with the exam, put it back into the envelope and check the watch to remember how long you needed to complete the questions **(Instruction for supervisor: point to watch in the room now)**. I will not answer any questions regarding the content of the practice exam.

The small envelope in front of you contains a short questionnaire that we ask you to complete ***after*** you are finished with the practice exam. You are not required to fill out this questionnaire. However, if you do, we will pay you 5 EUR at the end of the session and we will use your responses for a research project that is currently conducted at Erasmus University. Your answers to this questionnaire will be processed completely anonymously and we will make sure that your answers will not be connected to your name by anyone. In particular, I – the supervisor – will not see or learn about your responses in the questionnaire at any time.

If you do not want to fill out the questionnaire, please return your practice exam to me when you are finished and quietly leave the room. You may wait outside if you want to know your exam result. I will grade all practice exams quickly after everyone is finished and has left the room and I will tell you your results after a few minutes, if you are interested. We will also announce the results on Blackboard later.

If you do fill out the questionnaire, please put it back into the small envelope when you have completed all questions, seal the envelope and remain silent in your seat until everyone is finished. When everyone is finished, I will come around to pay you the 5 EUR for participating in the research project and I will ask you to sign a list to confirm you have received the payment.
After this, I will ask everyone to leave the room and I will grade the practice exams. When I am finished, you can come in again and I will tell you your result. This will complete this session.

Do you have any questions at this point?

You can now open the large envelope and start with the practice exam. Good luck!

(Instruction to supervisor: Check the watch now and write down starting time of exam on the blackboard behind you!)

A3 - Post-experimental questionnaire – Sudoku 1

Please answer the questions below truthfully. When you are finished, put the sheet back into the envelope and return it to the supervisor of the experiment. Your answers are treated completely anonymously and will be processed independently of your name.

1) What is your age in years? _____

2) What is your highest educational achievement until now? Please mark one:

O Some secondary schooling
O Secondary school degree (e.g. high school, vmbo, havo, vwo)
O HBO or Bachelor's degree
O Master's degree
O PhD
O Other, not applicable

3) What is currently your main occupational status? Mark all that apply:

O Student
O Employee (part-time or full-time)
O Self-employed (part-time or full-time)
O Unemployed
O Housewife, househusband, home maker
O Retired
O Disabled
O Other, not applicable

4) Have you solved sudokus before?

O Yes
O No
O Don't remember

5) What is your current relationship status?

O Single
O Married
O Widowed
O In a relationship
O Divorced
O Other, not applicable

6) Please indicate to which extent you agree with the following statements on the 5-point scale below where **1** means "*strongly disagree*" and **5** means "*strongly agree*":

		1	**2**	**3**	**4**	**5**
a)	I am usually good with numbers and math	O	O	O	O	O
b)	I enjoy solving puzzles and riddles	O	O	O	O	O
c)	I find intelligence an attractive attribute in a sexual partner	O	O	O	O	O
d)	I find ambition an attractive attribute in a sexual partner	O	O	O	O	O
e)	I find diligence an attractive attribute in a sexual partner	O	O	O	O	O
f)	I tried really hard to solve the sudokus correctly and as fast as possible	O	O	O	O	O
g)	I find myself physically attractive and good-looking	O	O	O	O	O
h)	I am intelligent	O	O	O	O	O
i)	I am ambitious	O	O	O	O	O
j)	I am diligent	O	O	O	O	O
k)	Intelligence is important for solving sudokus fast	O	O	O	O	O
l)	Sudokus become easier to solve with experience and practice	O	O	O	O	O
m)	Puzzles and riddles are cool	O	O	O	O	O
n)	I was strongly motivated by the money in this experiment	O	O	O	O	O
o)	I am currently in love.	O	O	O	O	O

A4 - Post-experimental questionnaire – Exam experiment

Please answer the questions below truthfully. When you are finished, put the sheet back into the small envelope and return it to the supervisor of the experiment. Your answers are treated completely anonymously and will be processed by two different people to ensure that they will not be connected at any point with your name. In particular, the supervisor will not see or learn about your responses to this questionnaire at any time.

1) How many minutes after the start of the practice exam did you put your answers back into the envelope? (please check the watch and be accurate) _____

2) What is your age in years? _____

3) What is currently your occupational status? Mark all that apply:

O Student
O Employee (part-time or full-time)
O Self-employed (part-time or full-time)
O Unemployed
O Housewife, househusband, home maker
O Other, not applicable

4) Have you participated in an Economics of Entrepreneurship exam before?

O Yes
O No

5) What is your current relationship status?

O Single O In a relationship
O Married O Divorced
O Widowed O Other, not applicable

6) Please indicate to which extent you agree with the following statements on the 5-point scale below where **1** means "*strongly disagree*" and **5** means "*strongly agree*":

		1	**2**	**3**	**4**	**5**
a)	I usually receive high grades at university	O	O	O	O	O
b)	I enjoy this course	O	O	O	O	O
c)	I find intelligence an attractive attribute in a sexual partner	O	O	O	O	O
d)	I find ambition an attractive attribute in a sexual partner	O	O	O	O	O
e)	I find diligence an attractive attribute in a sexual partner	O	O	O	O	O
f)	I tried really hard to solve the exam correctly	O	O	O	O	O
g)	I find myself physically attractive and good-looking	O	O	O	O	O
h)	I am intelligent	O	O	O	O	O
i)	I am ambitious	O	O	O	O	O
j)	I am diligent	O	O	O	O	O
k)	Intelligence is important for solving this exam	O	O	O	O	O
l)	This type of exam becomes easier to solve with experience and practice	O	O	O	O	O
m)	Economics is cool	O	O	O	O	O
n)	Entrepreneurship as an occupation is cool	O	O	O	O	O
o)	Entrepreneurship as an academic subject is cool	O	O	O	O	O
p)	I was strongly motivated by the bonus points for this practice exam	O	O	O	O	O
q)	I am currently in love	O	O	O	O	O
r)	I find the supervisor of this exam is good looking	O	O	O	O	O
s)	I would say "yes" if the supervisor would ask me out on a romantic date	O	O	O	O	O

7) Please indicate to which extent you agree with the following statements on the 5-point scale below where **1** means "*strongly disagree*" and **5** means "*strongly agree*":

		1	**2**	**3**	**4**	**5**
a)	I see myself as extraverted, enthusiastic	O	O	O	O	O
b)	I see myself as critical, quarrelsome	O	O	O	O	O
c)	I see myself as dependable, self-disciplined	O	O	O	O	O
d)	I see myself as anxious, easily upset	O	O	O	O	O
e)	I see myself as open to new experiences, complex	O	O	O	O	O
f)	I see myself as reserved, quiet	O	O	O	O	O
g)	I see myself as sympathetic, warm	O	O	O	O	O
h)	I see myself as disorganized, careless	O	O	O	O	O
i)	I see myself as calm, emotionally stable	O	O	O	O	O
j)	I see myself as conventional, uncreative	O	O	O	O	O

A5 - Post-experimental questionnaire – Sudoku 2

Please check if the session and your participant number (the number on your seat) are filled in above. Next, please answer the questions below truthfully. When you are finished, put the sheet back into the envelope, seal it and return it to the supervisor of the experiment. Your answers are treated completely anonymously and will be processed independently of your name. In particular, the supervisor will not see or learn about your responses to this questionnaire at any time.

1) Please mark the classes you have participated in this academic year (2009-2010).

O Introduction to Entrepreneurship, Strategy, and Organization Economics (FEB13044)
O Economics of Innovation (FEM11011)

2) What is your age in years? _____

3) What is your highest educational achievement until now? Please mark one:

O Some secondary schooling
O Secondary school degree (e.g. high school, vmbo, havo, vwo)
O HBO or Bachelor's degree
O Master's degree
O PhD
O Other, not applicable

4) What is currently your main occupational status? Mark all that apply:

O Student
O Employee (part-time or full-time)
O Self-employed (part-time or full-time)
O Unemployed
O Housewife, househusband, home maker
O Retired
O Disabled
O Other, not applicable

5) Have you solved Sudokus before? Please mark one:

O No
O Yes, once
O Yes, a few times
O Yes, often
O Don't remember

6) What is your current relationship status?

O Single O In a relationship
O Married O Divorced
O Widowed O Other, not applicable

7) Please indicate to which extent you agree with the following statements on the 5-point scale below where **1** means "*strongly disagree*" and **5** means "*strongly agree*":

		1	**2**	**3**	**4**	**5**
a)	I am usually good with numbers and math	O	O	O	O	O
b)	I enjoy solving puzzles and riddles	O	O	O	O	O
c)	I find intelligence an attractive attribute in a sexual partner	O	O	O	O	O
d)	I find ambition an attractive attribute in a sexual partner	O	O	O	O	O
e)	I find diligence an attractive attribute in a sexual partner	O	O	O	O	O
f)	I tried really hard to solve the Sudokus correctly and as fast as possible	O	O	O	O	O
g)	I find myself physically attractive and good-looking	O	O	O	O	O
h)	I am intelligent	O	O	O	O	O
i)	I am ambitious	O	O	O	O	O
j)	I am diligent	O	O	O	O	O
k)	Intelligence is important for solving Sudokus fast	O	O	O	O	O
l)	Sudokus become easier to solve with experience and practice	O	O	O	O	O
m)	Puzzles and riddles are cool	O	O	O	O	O
n)	I was strongly motivated by the money / course credit for this experiment	O	O	O	O	O
o)	I am currently in love	O	O	O	O	O
p)	I find the supervisor of this experiment is good looking	O	O	O	O	O
q)	I would say "yes" if the supervisor would ask me out on a romantic date	O	O	O	O	O

8) Please indicate to which extent you agree with the following statements on the 5-point scale below where **1** means "*strongly disagree*" and **5** means "*strongly agree*":

		1	**2**	**3**	**4**	**5**
a)	I see myself as extraverted, enthusiastic	O	O	O	O	O
b)	I see myself as critical, quarrelsome	O	O	O	O	O
c)	I see myself as dependable, self-disciplined	O	O	O	O	O
d)	I see myself as anxious, easily upset	O	O	O	O	O
e)	I see myself as open to new experiences, complex	O	O	O	O	O
f)	I see myself as reserved, quiet	O	O	O	O	O
g)	I see myself as sympathetic, warm	O	O	O	O	O
h)	I see myself as disorganized, careless	O	O	O	O	O
i)	I see myself as calm, emotionally stable	O	O	O	O	O
j)	I see myself as conventional, uncreative	O	O	O	O	O

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