Gender and Competition at a Young Age

By URI GNEEZY AND ALDO RUSTICHINI*

Gender gaps in income and social position are widespread. For example, Marianne Bertrand and Kevin Hallock (2001) studied data on the five highest-paid executives of a large group of U.S. firms over the period 1992–1997. They found that only 2.5 percent of the executives in the sample were women. Such asymmetry has engendered heated controversy about the fairness of the selection process, and more generally about the allocation of opportunities. This controversy is fueled by strong opinions and is not likely to disappear. One of the reasons for such persistence, besides the real interests at stake, is that real-life selection processes bring into play many different factors that are difficult to evaluate separately. Nonetheless, laboratory experiments and field studies can provide precious additional evidence.

These gender gaps could be due to easily observable differences in abilities (e.g., the average man is stronger than the average woman). An alternative explanation for the difference is discrimination, for which direct evidence is hard to find (James Heckman, 1998; Heckman and Siegelman, 1993).[1] The gap could also result from gender differences that are unobservable to the econometrician, such as differences in preferences or a lack of long-term commitment from women (Bertrand and Hallock, 2001).

In this paper we extend the discussion by testing whether differences in competitiveness exist between men and women, and if so, whether they could help in explaining the gender gap (see also Gneezy et al. [2003], described below). We used a field study in which most of the confounding factors are removed. The results confirm the initial conjecture: competition enhances the performance of males, but not females.

A large body of literature in evolutionary biology and sociobiology documents differences in competitiveness between males and females in many species (see Jonathan Knight, 2002).[2] This literature argues that the differences in competitiveness are due to differences in the cost of reproduction: for males, the cost of participating in the reproductive process is very low, and so they will attempt to mate with many partners, and they will compete with other males in order to do so. Females, on the other hand, endure a much higher cost in parental investment and so are inherently much more choosy, rather than competitive.

I. Design of the Field Study

The study was conducted in an elementary school in the city of Ra'anana in Israel. The participants were 140 children, 75 boys and 65 girls, all in the fourth grade, and 9–10 years old. The dependent variable studied was the speed of the children in a race over a short distance.[3] The study was conducted during a physical education class and closely followed a standard practice in the class: every child has to run twice over a track 40 meters long, with the teacher measuring their speed.

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[1] There are important exceptions: for instance, the study by Claudia Goldin and Cecilia Rouse (2000) shows that blind auditions increase the proportion of women hired. A remedy that is typically associated with this analysis is affirmative action (see e.g., Harry Holzer and David Neumark [2000] for an assessment of the policy).

[2] The debate is a classic one in the field (see Charles Darwin, 1871; A. J. Bateman, 1948; R. L. Trivers, 1972). For other differences, see Rachel Croson and Nancy Buchan (1999), Andreas Ortmann and Lisa Tichy (1999), James Andreoni and Lise Vesterlund (2001), Caroline Hoxby (2002), and Catherine C. Eckel and Philip J. Grossman (2004).

[3] At this age, there is no gender difference in speed in a short-distance race. Our finding regarding speed in the first round supports this claim.

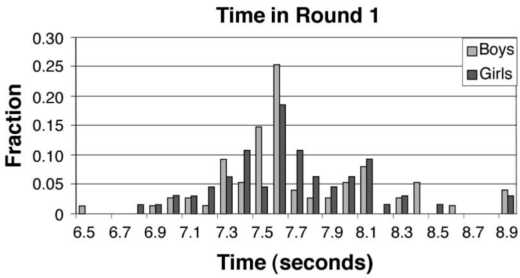

FIGURE 1. DISTRIBUTION OF RUNNING TIMES IN ROUND 1

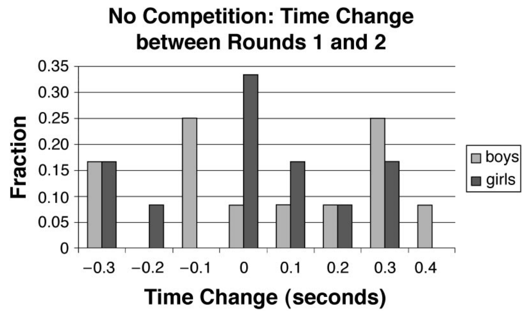

FIGURE 2. DISTRIBUTION OF CHANGE IN RUNNING TIMES (TIME IN ROUND 2 MINUS TIME IN ROUND 1) IN THE NO-COMPETITION TREATMENT

The precise procedure was as follows. First, each child ran once by him/herself. In the second stage, the teacher matched the children in pairs, starting with the two fastest children in the race. After matching the two fastest runners, the teacher moved down the list, each time matching the next two fastest children, independently of their gender. When more than two children had the same time in the first round, the match was decided randomly. In this way, children matched into pairs had very similar speeds. After the matching was completed, each pair ran on the same track, with the two children running side by side. A separate group of children ran alone a second time as well. This group provided a control for unobservable additional factors that may cause differences in the outcome. (For instance, one gender might get tired faster than the other, or recover more slowly and hence run at a lower speed in the second run.)

In each case, the teacher measured the time it took each child to complete the race. The children were not aware that they were part of a study, and they were not promised or offered any compensation. Children knew their own speed in the first round, as well as the speed of the child they were matched with, and all were familiar with the procedure from previous experiences in the class.

II. The Results

Speed in the First Round.—Since all conditions were identical in stage 1, we can pool the outcomes to test for gender differences and plot the distribution of time by gender (see Fig. 1). In the first round girls and boys ran at the same speed. The average time (here and always later, in seconds) was 7.672 for girls and 7.693 for boys; using the nonparametric Mann-Whitney *U* test based on ranks, we found that this difference is not significant ($p = 0.937$).

Speed in the Second Round.—We separate the discussion of the two treatment groups: first we examine the results of the "no competition" group, in which children ran alone in the second round, and then we discuss the "competition" group, in which they ran in pairs in the second round.

In the no-competition subgroup there were 24 children: 12 boys and 12 girls. The distribution of changes in times (time in round 2 minus time in round 1, such that a negative number corresponds to an improvement in speed in the second round), is presented in Figure 2, while Table 1 gives an overall summary of the time differences.

Children running alone in the first and second rounds showed, on average, a slight improvement in the second round: the average time fell from 7.79 to 7.75, a difference of −0.037 seconds. The difference in the improvement of performance between genders is not significant ($p = 0.839$ for the null hypothesis that the *time* in the second round is equal for the two genders; $p = 0.815$ for the null hypothesis that the *difference* in time between the two rounds is the same for the two genders). The *p* value for the percentage of improvement (the ratio between the difference in time and the time in the first round) is 0.663.

There were 116 children in the competition subgroup: 63 boys and 53 girls. Figure 3 presents the change in running time according to

TABLE 1—SUMMARY OF THE RUNNING-TIME CHANGES IN A NONCOMPETITIVE ENVIRONMENT

Sex	Number of observations	Time in round 2 − time in round 1	Standard error
Boys	12	−0.058	0.070
Girls	12	−0.016	0.058
Total	24	−0.037	0.044

gender, and Table 2 gives an overall summary of the results. The average change in time from the first to the second round was −0.081. Boys improved (−0.163 on average) while girls ran *slower* in the second round (an increase of 0.015 on average). The difference is significant: the p value obtained under the null hypothesis that the difference is the same across genders is 0.0005; the p value for the same test on the percentage of improvement is 0.0002.

Next, we consider the change in performance in the competitive environment according to the gender compositions of the pairs. In 10 (59 percent) of the 17 homogeneous pairs of boys, the boy who had a better time in the first round won in the second. In homogeneous groups of girls, six (50 percent) of 12 girls who ran faster in round 1 also ran faster in round 2. The time change between the two rounds, however, is noticeably different between boys and girls. When girls ran with girls, their performance was *worse:* the time increased by 0.066 seconds for the first runner (i.e., the girl who had a better time in the first round) and 0.0333 seconds for the second runner. The opposite happened with boys, who improved by a large margin when competing against another boy. The first runner improved by 0.182 seconds, and the second runner by 0.088 seconds.

In mixed-pair races, boys caught up with girls, but girls did not catch up with boys. In eight (73 percent) of 11 observations among the mixed pairs in which boys were slower than the girl in round 1, they won the competition in the second stage. In the remaining 18 mixed-pair races, where the girl had a worse time in the first round, a girl won in only three cases (17 percent) in the second round.

The time improvement in the group of mixed pairs was far larger for boys than it was for girls. A boy first runner improved by 0.183 seconds, and a boy second runner improved by

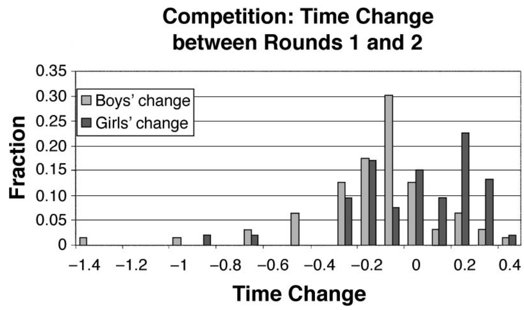

FIGURE 3. DISTRIBUTION OF CHANGE IN RUNNING TIMES (TIME IN ROUND 2 MINUS TIME IN ROUND 1) IN THE COMPETITION TREATMENT

0.218 seconds, which is the largest average gain. The gain for a girl running against a boy was small, 0.016 seconds, but this was still better than the *loss* for a girl running against a girl as second runner (0.033 seconds).

When comparing the performance of boys in homogeneous groups and in mixed groups, the p value for the difference is 0.6215, and for the percentage improvement it is 0.6988. That is, their speed was not affected by the gender composition of the group. Similar comparison of the performance of girls in homogeneous groups and mixed groups generates a p value of 0.094 for the difference and 0.0038 for the percentage (i.e., girls performed better when competing against boys than against girls).

III. Conclusions

The main finding in this paper is that competition improves performance relative to a noncompetitive environment for boys, but not for girls. In a related paper, (Gneezy et al., 2003) we reported the results of a laboratory experiment in which university students solved mazes on a computer. When participants were paid according to individual performance, there was no significant gender difference in outcome; when paid on a competitive basis, using a winner-takes-all scheme, the performance of the male participants increased significantly, while the performance of the female participants remained constant.

The current study extends Gneezy et al.'s (2003) results along a few important dimensions.

TABLE 2—SUMMARY OF THE RUNNING-TIME CHANGES IN A COMPETITIVE ENVIRONMENT

Sample	Number of observations	Time in round 2 − time in round 1	Standard error
Total	116	−0.081	0.045
Total boys	63	−0.163	0.036
Total girls	53	0.015	0.035
Boys with boys	34	−0.135	0.056
Girls with girls	24	0.050	0.045
Boys in mixed pairs	29	−0.190	0.043
Girls in mixed pairs	29	−0.013	0.053

First, it is based on a field study in which the participants performed a familiar task in a familiar environment, without knowing that they were being observed (see John A. List [2003] for an example of the use of field studies). Second, the age of the participants is, on average, less than 10 years (as compared with 23 in the maze study). This difference can help us determine whether the difference in competitiveness is due to socialization in the teenage years, or to something that begins at a much younger age. Third, we observed an open competition, since children saw the two competitors as they ran, and the competitors themselves received feedback regarding their relative performance during the race (as opposed to getting feedback only at the end). Finally, the competition was based on intrinsic motivation, since the children were not paid. This can help in determining whether males are more competitive only when an extrinsic monetary reward is offered, or whether it is enough to rely on solely intrinsic motivation (Bruno S. Frey and R. Jegen, 2001; Gneezy and Rustichini, 2000).

While the main result in this study regarding reaction to competitive incentives replicates the findings in Gneezy et al. (2003), it is interesting to note that in the current paper, when two girls were matched, performance did not improve in the second round relative to the first. This is in contrast to the maze experiment, in which the performance of women in the homogeneous groups improved relative to the noncompetitive environment. A possible explanation is that, even when two girls competed with each other, the rest of the class, composed of both boys and girls, was observing the competition.

Overall, we find support for the claim that competition increases the performance of males relative to females. It is remarkable that this effect appears in two very different environments. This indicates that some strong, robust, and general factors are involved. The puzzle that remains concerns the more subtle effects of competition in homogeneous and heterogeneous groups.

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