Is there a Gender Gap in Preschoolers' Competitiveness? An Experiment in the U.S.

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Abstract

We experimentally investigate the difference in competitiveness of 3-5 year-old boys and girls in the U.S. 124 children from a preschool are randomly matched into girl-girl, boy-boy, and boy-girl pairs of similar age and participate in a gender-neutral, competitive classroom activity using candy as an incentive. Children participate in a piece rate incentive scheme and a tournament incentive scheme in rounds 1 and 2, and select their preferred incentive scheme for round 3. We find that girls and boys choose to compete at equal rates – with 80% of children choosing to compete overall. We also find that girls' output in the task is significantly lower than that of boys under the tournament scheme, but not different in round 3 for the girls and boys who self-select into the tournament. All children display a remarkable rate of confidence – 84% of children believe they won under the tournament scheme. The gender of the match does not play a significant role.

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NOTES: The experiment conducted for this paper and related research has been conducted with The University of Chicago Institutional Review Board (IRB) approval. No other papers used data from the same experiment.

1. Introduction

While women in many Western countries are pursuing higher education at similar rates as men, women continue to have relatively lower earnings and are significantly less likely to hold executive positions in firms. In the U.S. in the last 50 years, this difference in earnings amounted to an earning rate of women that was 79% of men's in 2007 (and 64% of men's in 1957).[1] Women only account for 2.5% of the highest paid executives in the U.S. (Bertrand and Hallock, 2001). Earning rates in other Western countries are similar, and range from 75% (Austria) to 95% (Italy).[2] Studies conducted in a laboratory setting suggest that one factor contributing to this persistent wage gap is the difference in competitiveness between men and women (Niederle and Vesterlund, 2005; Gneezy et al., 2003). The difference in competitiveness has also been suggested as a factor accounting for differences in male and female achievement in math tests (Niederle and Vesterlund, 2010) and inclination to take competitive math exams (Zhang, 2011).

Studies of competitiveness in children help illuminate the nature of the gender gap, pinpointing whether the willingness to compete is a learned or inherent human trait and providing evidence for how the willingness to compete evolves over time. We contribute to this nascent literature through an artefactual field experiment conducted in 10 different preschool classes from two preschool campuses in the Chicago Heights, U.S. Children in the preschool are 3-5 years old. 124 children were randomly matched into girl-girl, boy-boy and boy-girl pairs of similar age and participated in a gender-neutral, competitive classroom activity using candy as an incentive. Children participated under a

[1] U.S. Census data
[2] The Social Situation in the European Union report: 2007

piece rate incentive scheme and a tournament incentive scheme in rounds 1 and 2, and selected their preferred incentive scheme for round 3. Common measures of competitiveness in related literature are performance under the tournament as compared to performance under the piece rate, and the choice to enter into a tournament.

Several recent studies find mixed evidence for the existence of a gender gap in competitiveness at an early age (Sutter and Rutzler, 2010; Dreber et al., 2010; Gneezy and Rustichini, 2004; Andersen et al., 2011). Reasons cited for the disagreement between these studies are that cultural and contextual factors matter across countries and tasks. Our experiment is the first to consider preschool children in the U.S.

We find that girls and boys choose to compete at equal rates in our experiment – with 80% of children choosing to compete overall. Girls' output in the task is significantly lower than that of boys under the tournament scheme, but not different in round 3 for the girls and boys who self-select into the tournament. All children display a high rate of confidence – 84% of children believe they won the competition under the tournament scheme. The gender of the match does not play a significant role.

2. Related Literature

Research studies conducted in a laboratory setting with undergraduate students find that women compete less than men in various tasks. The two most common tasks used for research with adults are adding two digit numbers (e.g., Niederle and Vesterlund, 2007) and solving mazes (e.g., Gneezy et al., 2003, Datta Gupta et al., 2005). Niederle and Vesterlund (2007) find that men select the tournament incentive scheme twice as much as women in an adding numbers task, although there are no inherent

gender differences in performance in adding numbers. Gneezy et al. (2003) find that men increase performance as a response to competition, but women do not. Subsequent studies support these results – men enter contests more frequently than women, even proportional-payment contests that are less risky (Cason et al., 2010).

Suggested reasons for the gender gap in competitiveness are differences in overconfidence (Niederle and Vesterlund, 2007) differences in risk aversion (Croson and Gneezy, 2009; Eckel and Grossman, 2002; Powell and Ansic, 1997) differential responses to losses or wins (Gill and Prowse, 2010), stereotype threat (Gunther et al., 2010) and hormonal differences (Wozniak et al., 2009). The latter result is complemented by a series of psychology studies, which find that young boys, but not girls, prefer competitive environments, and that the preference for competition among boys increases through puberty and remains different from that of women in adulthood (see Campbell, 2002, for an overview).

Various potential policies targeted at reducing the gap in competitiveness have been tested in a lab setting, including an affirmative action program that guarantees a minimum percentage of women among the winners of a tournament (Niederle et al., 2009), providing additional information in the form of performance feedback (Ertac and Szentes, 2011; Wozniak et al., 2009), repetition of competition if a critical number of women winners is not reached and preferential treatment of women through a gender-specific bonus (Balafoutas and Sutter, 2010). The affirmative action program, the gender-specific bonus and increased information have a significant and positive impact on the proportion of women who choose to engage in competition.

The studies described above are in agreement about the existence of the gender gap in competitiveness among adults in Western cultures, and several underlying differences in preferences have been cited as reasons for the gap. However, the question remained, does the gender gap in competitiveness exist due to 'nature' or 'nurture'? Gneezy et al. (2009) recently reported clear evidence that culture and socialization is a significant factor accounting for differences in competitive behavior. The authors conducted a series of field experiments in matrilineal and patriarchal societies in Tanzania and India, finding that men in the patriarchal society compete twice as often as women, but that women choose to compete more in the matrilineal society. If it is 'nurture,' rather than 'nature,' that plays a major role in the gender gap, then interventions during a child's development could potentially serve to reduce the gender gap in competitiveness. It is well known in the human development literature that character trait formation takes place in the first few years of life (Kail and Cavanaugh, 2010), but when in the lifecycle the competitiveness gap develops is less clear.

A recent series of studies have begun to address the question of when the gap in competitive behavior begins to emerge among children and adolescents. The related literature has reported mixed results, and it has been suggested that culture and context may play an even bigger role than initially expected. The studies can be classified into two types: the first type that targets measures of difference in performance in tournaments, and the second type that targets measures of willingness to compete. In addition, studies have differed in choice of context, using math problems, mazes, running, skipping rope, throwing a ball into a bucket, and modern dance competitions.

Gneezy and Rustichini (2004) studied the difference in performance in competing in a running task in Israel, and found that 9-10 year-old boys increase performance when competing, but girls do not. Dreber et al. (2010), on the other hand, conducted a study in Sweden and found that 8-10 year old children display equal performance when competing across "gendered" and neutral tasks, including running.

Booth and Nolen (2009) measured willingness to enter a competition in Britain, and found that 15-year-old boys are more likely to enter competition than 15-year-old girls who attend coeducational schools. However, 15-year-old girls attending same-sex schools do not display these differences, providing further backing for the socialization argument. Complementing this result, Andersen et al. (2011) used a 'throwing a ball in a bucket' task to examine children ages 7-15 in a matrilineal and patriarchal society, and determined that the gender gap in willingness to compete starts around puberty, but is only apparent in the patriarchal society. On the other hand, in a large-scale study in Austria of children ages 3-18 years old, Sutter and Rutzler (2010) found a persistent gender gap in willingness to enter competition at all ages. In Sutter and Rutzler's study, younger children participated in a running task while older children participated in the math task.

In sum, while researchers are in agreement that gender differences in competitiveness exist and are significant among adults, the research results are mixed on gender differences in children. The general consensus regarding competitiveness in children is that culture and context must play a significant role, yet to date, the handful of studies that exist have only been conducted in Israel, Austria, Sweden, Britain, and matrilineal and patriarchal societies in India and Tanzania. Moreover, the only study of

children as young as age 3-5 was conducted in Austria, and included only the willingness to compete measure. We contribute to the literature through a study in the U.S. of 3-5 year old preschool children. To the best of our knowledge, this is the first study on children's competitiveness in the U.S., and only the second study with such a young age group. Moreover, our design allows us to consider both the performance in the tournament and willingness to enter into the tournament.

Standard maze or math tasks are not age appropriate for very young children. To solve this problem, Sutter and Rutzler (2010) utilized a running competition. We developed a new, gender-neutral 'fishing task' with pictorial instructions to use with our population. In our task, children are compensated based on how many 'fish' they remove from a 'pond,' using candy as an incentive. A benefit of our task as compared to a running competition is that we provide feedback about own performance, but do not instant provide feedback about the partner's performance. This allows us to elicit confidence about performance immediately after the task.

2. Experiment Procedures and Design

2.1 Procedures

The studies were conducted at the Griffin Early Childhood Center (GECC) Preschool program in March of 2011. The GECC program was launched in August, 2010 and serves as a 'laboratory' for experiments of this sort. The GECC preschool is situated on two campuses with 5 classrooms in each campus. Children know others from their own classroom, but generally do not interact with children from other classrooms (lunch

is eaten in the classroom, and classrooms participate one at a time in Gym class and recess). 124 children ages 3.5 to 5.5 (63 girls and 61 boys) participated in the study.

For each session, 2 children were randomly selected to make a 'pair.' Within the pair, children were selected to be from 2 different classrooms in the same preschool and to be within 4 months of age from each other. Each subject participated in the study only once. We created girl-girl (20 pairs), girl-boy (23 pairs) and boy-boy (19 pairs).

Two children at a time (the 'pair') were taken out of their classrooms to participate in a session of the experiment in a small, adjacent room. Children saw who they were paired with as they walked down the hall, but were separated with a divider once they arrived in the experiment room. Thus, children knew the gender of their match at the beginning of the study, were presumed not to know the ability level of their match (since they were from the other classroom), and did not physically see the match for the duration of the experiment (talking or exclaiming out loud was also strongly discouraged).

We followed standard GECC procedures when implementing the study. One female experimenter and an assistant were trained to conduct the study by the author. Children were told that they would 'play a game' with the experimenter and that there would be candy. All of the children who were recruited indicated that they would like to participate, although participation was optional. The experimenter read the script (see Appendix I) and the assistant took notes during the experiment. The script was interactive, involving several quiz questions on understanding and including pictures that represented the basic information about each incentive scheme. Children answered quiz questions by pointing to the answer on their instruction sheet.

Each session lasted approximately 10-12 minutes. Children could earn between 0 and 20 candies during the experiment, and received a 'surprise bonus' participation fee of one sticker and one candy at the end of the experiment. Children watched the experimenter put all of their 'earned' candy into a paper bag with their name on it, to be taken home at the end of the day. Children received the sticker immediately. Figure 1 shows the setup of the experimental environment.

Figure 1: Experimental Environment

2.2. Experimental Design

In the 'fishing task,' the participant 'catches' a fish using a magnetic pole, while fish 'swim' on a plate that spins slowly.[3] Each 'caught' fish is dropped in a bucket. This type of game is meant to encourage fine motor skills and hand-eye coordination. There are no known gender differences in development of these skills with preschoolers.

[3] The Fishing Task is adapted from the classic Let's Go Fishin' game for children by Pressman Toy. We magnetized the fishing poles, and replaced the pond and colorful fish with plain, cardstock fish for the experiment. Each child had his/her own pond, fish and pole. We also added a bucket for dropping fish.

Performance (fish output) in this task depends jointly on ability and effort. Figure 2 shows a photo of a child participating in the task.

After listening to the instructions, children participated in 1 practice mini-round (10-15 seconds) designed to teach how to hold the 'fishing pole' and how to follow the 'start' and 'stop' directions.[4] The practice round was followed by 3 rounds of play, including a piece rate incentive scheme, a tournament incentive scheme, and a round in which the child self-selected into the piece rate or tournament. Each round consisted of 30 seconds during which the child could catch fish without replacement out of 10 available in the 'pond.'

Under the piece rate incentive scheme, each fish caught was equivalent to one candy. Under the tournament incentive scheme, each fish caught was equivalent to two candies for the winner of the tournament, but no candies for the loser of the tournament. Children received feedback on their own performance (they knew how many fish they caught) during each round, but did not receive feedback about the others' performance until the end of all three rounds. We also elicited the child's beliefs about whether he/she won the tournament or not at the very end of the experiment. At the end of the experiment, one of the rounds was randomly selected for payment. Each child was asked to close his/her eyes and reach into a box with buckets containing fish caught from each of the rounds – the bucket randomly selected using this procedure was paid out.

Table 1 summarizes the treatments that were conducted. Treatments differed in the order of incentive schemes for rounds 1 and 2 - subjects either participated in Piece Rate followed by Tournament, or Tournament followed by Piece Rate. Treatments also

[4] The mini-round did not give children a chance to become more proficient in doing the task, because each child was given enough time to catch 1 fish.

varied in pair composition – girl/girl, boy/boy or girl/boy. This design feature allows us to make between-subjects comparisons, measuring the difference in performance across genders when the tournament is played first and when the piece rate is played first, and allows us to control for the order effect when measuring within-subject variation as well. Treatments also differed in the composition of the group – we conducted treatments with boy-boy, boy-girl, and girl-girl pairings.[5] 68 children in total participated in order 1 (piece rate – tournament), and 56 children in total participated in order 2 (tournament – piece rate).

Figure 2: The Fishing Task

Table 1: Treatments

	Boy-Boy Pairing	**Boy-Girl Pairing**	**Girl-Girl Pairing**	***TOTAL***
Order 1 (Piece Rate – Tournament)	22 children (11 pairs)	24 children (12 pairs)	22 children (11 pairs)	*68 children (34 pairs)*
Order 2 (Tournament – Piece Rate)	16 children (8 pairs)	22 children (11 pairs)	18 children (9 pairs)	*56 children (28 pairs)*
TOTAL	*38 children (19 pairs)*	*46 children (23 pairs)*	*40 children (20 pairs)*	

[5] We attempted to have the same number of pairings for each treatment, but due to absences of some children on certain days, we were unable to have exactly the same numbers.

In round 3, after experiencing both types of incentive schemes, children from both treatments were given the choice to participate in either the tournament or piece rate scheme. Children did not know what the other child had chosen prior to participating in round 3. Children made their choices by silently pointing to the image corresponding to the type of scheme they wanted to play under.

At the conclusion of all three rounds of the experiment, children were asked to respond to the question "I did better than the other person in the [point to tournament scheme picture] game where the person who caught the most fish got 2 candies for each fish, but the person who caught less fish got no candies for each fish" using a 3-point pictorial Likert scale. Children were also asked several questions about whether they thought they did better because they were good at the task, because they tried hard, or because of luck. Appendix II summarizes the procedure and Likert scale used to help children answer these questions.

3. Results

3.1 Piece Rate

Table 2 summarizes the average fish output under the piece rate scheme. On average, children caught a total of 7.15 fish out of 10 under the piece rate (standard deviation: 1.52), with a minimum of 2 fish and maximum of 10 fish caught. As expected, there are no significant differences in performance across the two genders under the piece rate scheme when it is played first or when it is played second (p-value 0.62, overall; 0.17, order 1; 0.40, order 2). Figure 3 displays a histogram of fish output for all children under the piece rate when piece rate is played first in the sequence. While we do not find

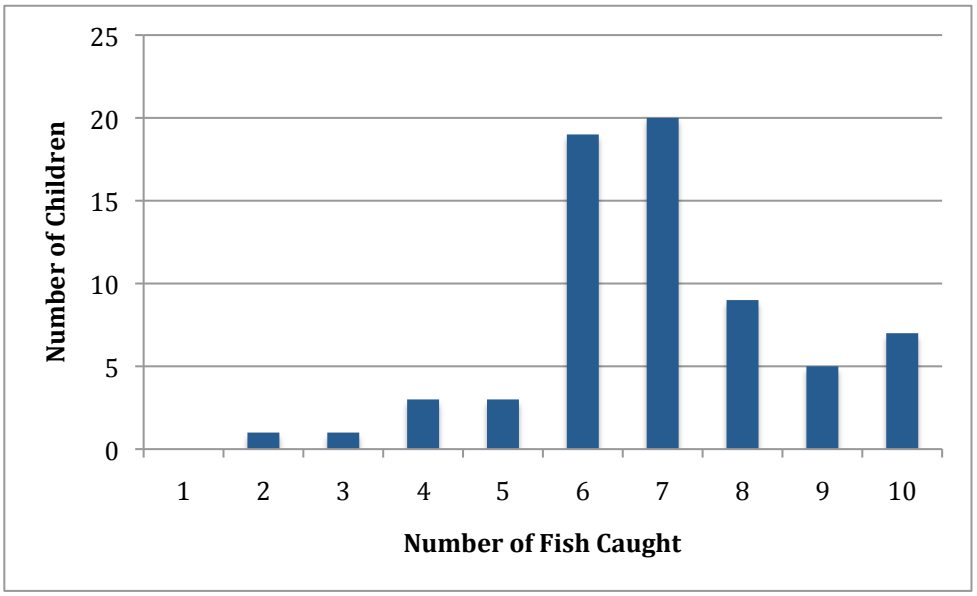
significant gender differences, we do find individual differences in performance across subjects.

Table 2: Performance Under Piece Rate*

	Boys	Girls	Average
Order 1 (Piece Rate – Tournament)	6.71 (1.94)	7.21 (1.37)	6.96 (1.68)
Order 2 (Tournament – Piece Rate)	7.56 (1.31)	7.21 (1.24)	7.38 (1.27)

**Standard deviation in parentheses*

Figure 3: Histogram of Fish Output Under Piece Rate



3.2 Tournament Performance

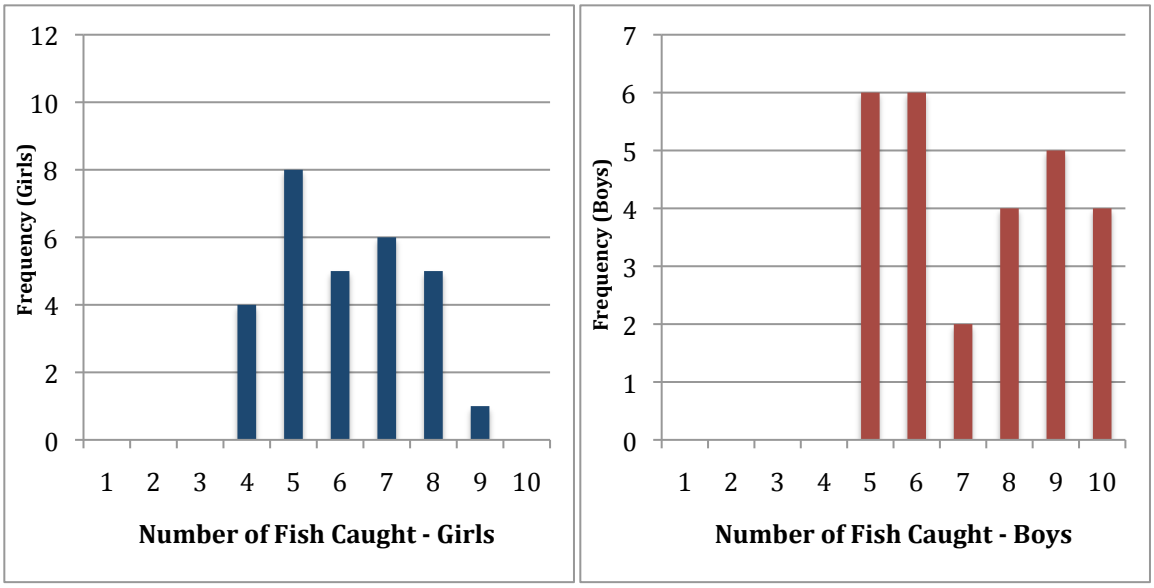
Table 3 displays performance (fish output) under the tournament incentive scheme. We find that girls perform significantly worse than boys under the tournament (Wilcoxon *p*-value = 0.03). This difference in performance is driven entirely by a difference in Order 2, when the tournament is played first (Wilcoxon *p*-value = 0.02, order 1; 0.49, order 2). Figure 4 displays a histogram of fish output by gender, when the tournament is played first. Note the shift to the right for boys – while none of the girls

caught all the fish (10), 4 boys were able to catch all 10 fish. In addition, while only 1 girl caught 9 fish, 5 boys did. The median number of fish caught by girls is 6 and the median number of fish caught by boys is 7.

Table 3: Performance Under Tournament

	Boys	**Girls**	**Average**
Order 1 (Piece Rate – Tournament)	7.56 (1.73)	7.23 (1.82)	7.40 (1.77)
Order 2 (Tournament – Piece Rate)	7.29 (1.84)	6.10 (1.45)	6.68 (1.74)

Figure 4: Performance Under Piece Rate, Girls (Left) and Boys (Right)



Result 1: Boys perform significantly better than girls under the tournament, and this effect is primarily driven by differences when the tournament is played in the first round.

Our results suggest that the gender gap in competitiveness between boys and girls is most intensified under unfamiliar environments, and is attenuated by experience in the

task (by round 2, the fishing game is more familiar to boys and girls). A performance gap under the tournament has not been documented to date with this age group. Our result is in line with the gap in performance observed in running tasks with 9-10 year-old Israeli boys (Gneezy and Rustichini, 2004), but different from the equal performance found among 8-10 year-old Swedish boys and girls in various "gendered" and neutral tasks (Dreber et al., 2010). Dreber et al. (2010) suggest that one reason for the lack of gender gap in performance in their task that Sweden is a particularly equal society as compared to most other Western countries.

3.3 Entry into the Tournament

In round 3, after experiencing two rounds of the task and both incentive schemes, but before receiving feedback about relative performance, children decide whether to enter into the tournament or the piece rate. Overall, 80% of children (99 out of 124) chose to enter the tournament, while 20% chose to participate under the piece rate.[6] There are no significant differences on entry by gender. 83% of girls (52 out of 63) and 77% of boys (47 out of 61) selected the tournament incentive scheme (Chi^2 *p*-value = 0.45). Conditional on entering the tournament (piece rate), boys perform marginally better than girls (7.94 fish for boys versus 7.75 fish for girls), but the difference is not significant (*p*-value = 0.41). Conditional on choosing the piece rate, girls perform marginally better than boys (7.73 fish for girls versus 7.14 fish for boys), but again the difference is not significant (*p*-value = 0.39). The lack of significant differences in performance of girls

[6] There is no significant difference in the rate of choosing the tournament in the third round if the tournament was played first (82% choose tournament) compared to if the tournament was played second (77% choose tournament). Chi^2 *p*-value = 0.44.

and boys under the tournament in round 3, together with lack of significant differences under the tournament when it is played second, provides additional evidence that experience may play a role in the gender gap.

Table 4: Performance in Round 3, by Entry Choice

	Boys	**Girls**	**Average**
Piece Rate	7.14 (1.70)	7.73 (1.35)	7.75 (1.54)
Tournament	7.94 (1.85)	7.75 (1.60)	7.75 (1.83)

Result 2: Boys and girls do not differ significantly in their choice to enter the tournament.

The lack of difference in willingness to enter the competition supports related work in the matrilineal and patriarchal societies with 7-15 year-old boys, which suggests that the gender gap in willingness to compete is not apparent until adolescence (Andersen et al., 2011). It is also supported by the finding that hormonal differences, which become more pronounced in adolescence, play a role in willingness to compete (Wozniak et al., 2009). However, our result is different from the result of Sutter and Rutzler (2010), who find that differences in willingness to compete in running competitions emerge among Austrian children as early as age 3-5.

3.4 Pair Composition & Within-Game Variation

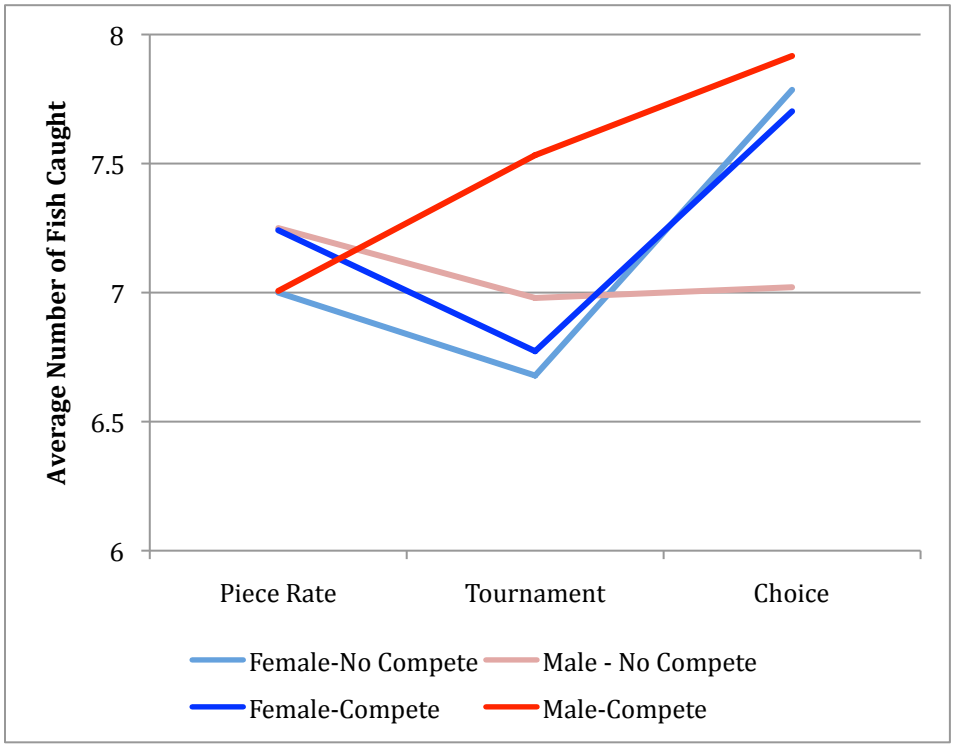
We also consider whether the make-up of the pair impacts performance in the tournament and choice to enter the tournament. We find no significant differences in performance under the tournament when it is played first or when it is played second

across the different gender pairings (p-values > 0.10). Girls competing against other girls catch 6 fish on average (standard deviation: 1.32), while girls competing against boys catch 6.27 fish on average (standard deviation: 1.68). Boys competing against other boys catch 7.56 fish on average (standard deviation: 1.79), while boys competing against girls catch 6.91 fish on average (standard deviation: 1.92). In contrast, related work finds that girls perform better when competing against other girls as compared to competing against boys (Booth and Nolen, 2009; Gneezy and Rustichini, 2004).

We also investigate whether the willingness to compete is related to the pair composition. We find that girls are equally likely to enter competition when paired with a boy as when paired with a girl (82% in both cases). Boys are slightly less likely to enter the competition when paired with a girl than when paired with a boy (74% versus 79%), but this marginal difference is not statistically significant (p-value = 0.65).

Figure 5 displays performance of girls and boys in all rounds (aggregating piece rate and tournament), conditioning on whether they chose to enter the competition. We do find that boys who choose to compete in round 3 did significantly better in the tournament than boys who chose the piece rate. Boys who choose to compete do significantly better in Round 3 relative to boys who choose piece rate (p-value = 0.10), and this is due either to the knowledge that one is better in the tournament, or due to improved performance for boys when participating in the tournament. Girls, on the other hand, do not appear to condition on past performance when making choices about competing.

Figure 5: Performance Across Tasks Conditional on Choice to Compete



We also consider how performance changes across rounds within subjects, accounting for becoming familiar with the fishing task and gaining experience in catching fish. We conducted random effects panel regressions separately for girls and boys to investigate factors affecting performance across the tasks, and results are summarized in Table 5. We find that girls and boys improve performance across the two rounds due to learning or experience at similar rates, and this improvement is statistically significant. However, we observe a significant negative coefficient for girls when playing under the tournament as compared to under the piece rate, and this variable is not significant for boys. The gender of the match does not have a significant effect for either girls or boys.

Table 5: Regression Models of Individual Performance, Round 1 and 2

Dependent Variable: Performance (Fish output) in task	**Girls** (1)	**Boys** (2)
Round #	0.57**	0.56*
(Rounds 1 through 2)	*(0.19)*	*(0.25)*
Tournament Dummy	-0.54**	0.29
(= 1 if tournament, 0 otherwise)	*(0.19)*	*(0.25)*
Gender of the match	0.13	0.15
(=1 if male, 0 if female)	*(0.70)*	*(0.39)*
Observations	126	122
Number of subjects	63	61

** p<0.01, * p<0.05. Standard errors in parentheses.

3.5 Winning and Confidence

At the end of all three rounds, participants rated their confidence on a scale of 1 to 3, where 1 is 'disagree' with the statement that one is better, 3 is 'agree' with the statement, and 2 is 'neutral.' This statement referred simply to the 'tournament game,' and we left ambiguous whether this referred to round 3 or round 1/2, since we did not want to make the question too complex for young subjects. Therefore, we compare the confidence both to performance in round 3 (if the tournament was chosen) and to when the tournament was played in round 1 or 2. We also investigate whether confidence was correlated with entry into the tournament in round 3.

Matches can be separated into those with a clear winner and those in which there was a tie. In first time the tournament was played, 15 matches resulted in ties while 47 matches resulted in one clear winner. In the third round (whether it was a tournament or a piece rate selection), 18 matches resulted in ties while 44 matches resulted in one clear winner. Of subjects who selected to participate in a tournament, 31 subjects experienced a tie and 68 subjects experienced a clear winner.

Overall, we find that 85% of subjects 'agreed' that they were better, 11% 'disagreed,' and only 4% were 'neutral.' We define a confident subject as a participant who 'agreed' to the statement that he/she did better. Confidence is slightly greater in boys (88.5%) as compared to girls (80.9%), but this difference is not statistically significant (Chi^2 *p*-value 0.24). Confidence was not correlated with entry into the tournament in round 3, as 85% of subjects who chose to enter into the tournament were confident, while 84% of subjects who chose to enter the piece rate were confident (Chi^2 *p*-value 0.92).[7]

In the tournament when it is played initially, of those who agreed with the statement that they did better, 52% (42 subjects) actually won while 48% (39 subjects) did not win. In the tournament, if it was selected in the third round, of those who agreed with the statement that they did better, 53% (31 subjects) actually won and 47% (27 subjects) did not win. In tie cases, 80% (24 subjects) agreed with the statement that they did better in the tournament played initially, and 84% (26 subjects) agreed with the statement that they did better in the tournament played third. Average fish output for confident subjects was 7.12, 7.16 and 7.76 in the piece rate, tournament and choice rounds, respectively, while average fish output for subjects who were not confident was 7.26, 6.57 and 7.68, respectively. Confidence is not significantly correlated with output (*p*-values > 0.15 for all pair-wise *t*-tests).

Overconfidence is defined as 'agreeing' with the statement that one did better than the other person in the tournament, if in fact one did not win the tournament. The calculated rate of overconfidence when the question is applied to the tournament played

[7] The rate of confidence (and overconfidence) that we observed is greater than that found in related literature, and this could be due to the way the question was framed (we did not do a follow-up question asking children to 'agree' that they *did not* perform better). Therefore, the results about confidence should be interpreted with some caution.

initially is 48% (37% if ties count as wins), and the calculated rate of overconfidence for the tournament if it is selected in the third round is 47% (32% if ties count as wins). This rate of overconfidence is not significantly different for boys as compared to girls (Chi^2 test *p*-value = 0.98, 0.39, respectively).

5. Discussion and Conclusion

We experimentally investigated the difference in competitiveness of 3-5 year-old boys and girls in the U.S. in a classroom 'fishing task.' This study provides a contribution to the literature on the role of 'nurture,' culture and context in the gender gap in competitiveness that develops as a child grows up. This is the first study conducted on children in the U.S., and is the second to consider competitiveness among children as young as 3-5. We also introduced a new task, the 'fishing task,' and validated that there are no gender differences in baseline performance in this task.

Competitiveness is generally measured using either performance under the tournament incentive scheme or willingness to compete in a tournament. Unlike related work with children of this age, we are able to measure both performance under the tournament incentive scheme and willingness to enter into the competition. We found different results for both of these measures in our sample of 3-5 year-old U.S. preschoolers. Girls performed significantly worse in the tournament, especially when they were unfamiliar with the task. However, with experience, girls enter into the tournament at equal rates as boys (80% of children enter the tournament). These differential results may suggest that girls as young as ages 3-5 already perform more poorly in unfamiliar competitive environments compared to boys. Introducing a

competitive environment and providing experience may be important for girls at this age to encourage improved performance under competition in practical settings, such as in the classroom.

More work is needed to understand the role of experience on competition at a young age, and the way that both performance under a competitive incentive scheme and willingness to compete develop over time. Future work can provide input into theoretical models of competitiveness, and can pinpoint the role of 'nature' versus 'nurture' at different stages of development as it relates to both performance and willingness to compete. In addition, future work will allow us to develop appropriate interventions and policies for children to reduce the gender gap in competitiveness in Western societies.

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Appendix I: Experiment Script/Instructions

Today both of you are going to do a fishing activity. But each of you do the activity, so I'm going to put this divider between you, okay? [put divider up half-way]. Also, your choices in the activity are *secret,* so you shouldn't talk during the activity unless I say so.

FISHING

You're going to do 3 games. Your job *in each game* will be to catch fish for 30 seconds and put them in a bucket. After each game, you will put your bucket full of fish in **your prize box** [show box]. At the **end** of ALL the fish games, you get to close your eyes and pick out one of the buckets, and that will be the prize that you get to take home.

Here are the rules:

- You can only use the fishing pole to catch fish
- You can't use your hands to catch fish – if you use your hands, you won't get to play any more and you won't get prizes.
- When you catch a fish, you put it in your bucket
- Don't talk during the activity – the amount of fish you catch is secret!
- When I say "start" you can start the game.
- When I say "stop", the game will end and you have to stop catching fish, even if you did not finish catching all of them.

Now we are going to practice. Let's each try to catch 1 fish. Here are your fishing poles. When I say "start" you can go ahead and start. Okay, "start"! [start fishing machine, wait until each child has caught a fish, stop machine] Okay, stop!

With the fishing activity, the amount of fish you catch **depends on how hard you try.** Okay?

Do you both like candy? In the activity you can also win candy [show candy].

Game 1/2 – Piece Rate

In this game, you win 1 candy for each fish you catch. That means it doesn't matter what NAME_CHILD1 catches, you get 1 candy for each of your fish, no matter what. And it doesn't matter what NAME_CHILD2 catches, you get 1 candy for each of your fish, no matter what. That means that if this game is the one that counts, I'll count up how many fish are in your bucket and you will get one candy per fish.

So you remember what game we are on, I'm going to put the sign up in front of you like this. Okay? This means it's the game where you **always** get 1 candy per fish.

- Now do you remember, how many candies do you get for every fish? [ask for response separately from each child, then say "yes that's right, you get one candy for each fish" or "no, you get one candy for each fish."
- What should you use to catch the fish? Hold up your fishing pole ["Yes that's right, the fishing pole – you can't use your hands!" or "No, you have to use the fishing pole, you can't use your hands!"

Alright. We'll start the game. The amount of fish you catch depends on how hard you try!

Ready, set, "start."

Okay, "stop!"

Good job, now I am going to put both of your buckets in your prize box and we will go to the next game.

Game 2/1 – Tournament

In this game, how many candies you win depends on who catches the most fish. If *you* catch **more fish** than the other person, you get 2 candies for each fish you catch. But if *you* catch **less fish** than the other person, you do not get any candy. So if NAME_CHILD1 catches the most fish, she/he gets 2 candies per fish and NAME_CHILD2 gets no fish. But if NAME_CHILD2 catches the most fish, she/he gets 2 candies per fish and NAME_CHILD1 gets no candies. That means if this game is the one that counts, I'll count up how many fish are in each bucket. The one with the most fish will get 2 candies per fish. The one with less fish will not get any candies. If you both catch the same number of fish, you **each** get 1 candy per fish instead.

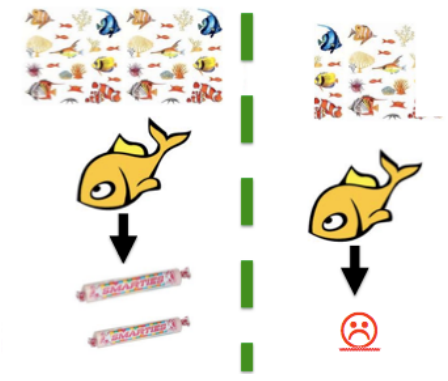
So you remember what game we are on, I'm going to put the sign up in front of you like this. Okay? This means it's the game where the person who catches the most fish gets 2 candies per fish, and the person who catches the least fish doesn't get any candies.

- Now, do you remember, how many candies for each fish does one who catches the MOST fish get? [yes, that's right 2, or no, 2]
- How many candies for each fish does the one who catches less fish get? [yes, that's right, the one who catches less fish doesn't get candies; or no, the one who catches less fish doesn't get candies']
- What should you use to catch the fish? [That's right the fishing pole]

Alright. We'll start the game. The amount of fish you catch depends on how good you are at it and how hard you try!

Ready, set, "start."
Okay, "stop!"

Good job, now I am going to put both of your buckets in your prize box and we will go to the next game. We'll find out who won later.



Game 3 – CHOICE

Okay, let's go to game 3. Now you tried out both types of games. Here is the sign that shows the types of games.

(1) Remember, in *this* game your candy winnings don't depend on how the other person does, you get 1 candy per fish no matter what. So NAME-of-CHILD1 gets 1 candy per fish **and** NAME-OF-CHILD2 gets 1 candy per fish, no matter what.

(2) In *this* game your candy winnings depend on how the other person did. If NAME-OF-CHILD1 catches the most fish, then NAME-OF-CHILD1 gets 2 candies per fish and NAME-OF-CHILD2 gets no fish. But if NAME-of_CHILD2 catches the most fish, then NAME-OF-CHILD2 gets 2 candies per fish and NAME-OF-CHILD1 gets no fish.

This time, you get to choose which type of game you want to play next. Don't say anything yet – your choice is secret!

- First let's see if we all remember what each picture means. Can you point to the box that shows the game where you got 1 candy for each fish, and your candy doesn't depend on the other person? [Correct as needed]
- Next, can you point to the box that shows the game where you got 2 candies for each fish if you catch the most fish, and no candies if you catch less fish?

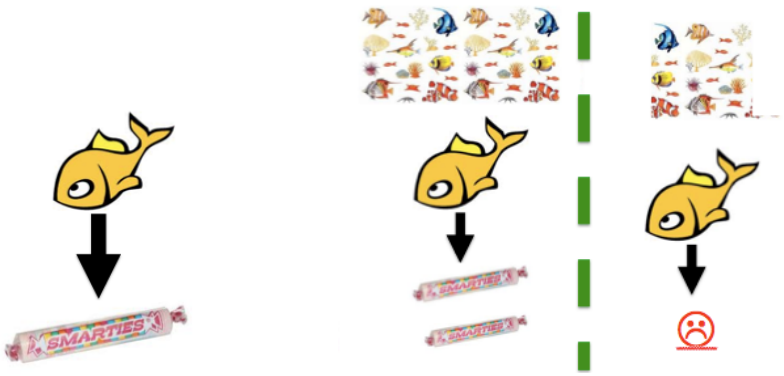
Remember, how many fish you catch depends on how hard you try.

Okay, now go ahead and point to the type of game you want to play. Its up to you!

Ready, set, "start."

Okay, "stop!"

Good job, now I am going to put both of your buckets in your prize box and we will go to the next game. We'll find out who won later.

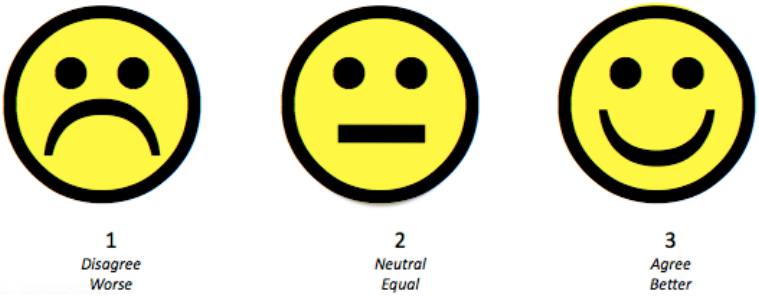


Appendix II: Questions about Confidence

Questions

Okay, before we find out how many candies you got, I'm going to ask you some questions. Your answers are *secret,* so you should point to the answers on your sheet.

Here's your answer sheet. I'll say a feeling, and you tell me how much you agree with it by pointing to the right smiley face. Let's give it a try. For example, I'll say "I like pink." If you agree with that a lot and you like pink, you point to *this* smiley face. If you don't agree with that at all and you hate pink, you point to *this* frowney face. And if you don't care or you don't know, you point to this middle one. Okay? (Have children practice this).



Questions about the **fishing** task?

____ **I think I did better than the other person** in the task where the person who caught the most fish got 2 candies per fish, but the task where the person who caught less fish got no candies per fish

____ I did well in this task because I was **lucky**

_____ I did well in this task because I am **good at these kinds of games**

_____ I did well in this task because I **tried hard**

OUTCOME

Okay, first everyone is going to get 1 bonus candy just for playing! I'm going to put it in your bag.

Ok now you close your eyes and pick which of the boxes counts for payment for the FISHES task. Now you can do it for the CARDS task.

Ok now we are going to check who won the games in each game.

Ok good job everyone, you get to pick a sticker and this is the bag that you will take home at the end of today.