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Gender differences in competitiveness: Friends matter☆

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ABSTRACT

We run an experiment with Danish school children (7-16 years old) to shed new light on gender differences in competitive behavior. Danish girls are not significantly less likely than boys to choose a competitive scheme when we control for individual performance, risk preferences, confidence, stereotypes, and interactions with the opposite gender. However, for the children who perform above average we find a gender gap of 11.8 percentage points. Our elicitation of the network of friends allows us to study the association between a child's and their friends' competitiveness: for each (extra) friend that is competitive, girls choose to compete more often (+9.6 percentage points). The same is not true for boys. Finally, boys become better at making the correct decision with age, but girls avoid competition when they should choose it.

1. Introduction

Gender differences in career choices and labor market outcomes are often associated with the different attitudes that men and women have towards competition. The pioneering work of Muriel Niederle and Lise Vesterlund suggests that men are twice as likely to self-select into competition (Niederle and Vesterlund, 2007). Dozens of subsequent studies have confirmed the general tendency for women to shy away from competition, but the estimated size of this gap varies enormously from one study to another. Individual risk preferences, confidence, and gender stereotypes all seem to be relevant factors that can help explain the heterogeneity of the observed gender gap (Dreber et al., 2011). To study the emergence of this gender gap, a growing body of literature has focused on aspects such as age, culture, task, quotas and social environments (for example Andersen et al., 2013; Cárdenas et al., 2012; Booth and Nolen 2012; Sutter and Glätzle-Rützler, 2015). The evidence for children is more mixed than for adults: for example, some papers report the presence of a gender gap in competitiveness already at an early age (for example: Gneezy and Rustichini 2003; Sutter and Glätzle-Rützler, 2015), while others find no significant gender differences (for example: Dreber et al., 2011; Khachatryan et al. 2015; Samek, 2013).

In this paper we report evidence from our experiment with 338 Danish children aged 7 to 16 using the Niederle and Vesterlund paradigm. Since previous studies have shown that the heterogeneity of the estimated gender gap can depend on the task used (Flory et al., 2018; Dreber et al. 2014), we propose a novel and intuitive real-effort task customized for children. We elicit children's beliefs about their relative performance, and we ask them to guess the performance of two "real" children, a boy and a girl. Finally, we measure children's risk preferences, and we elicit the network of friends in each class.

We also explore a possible channel that can affect competitiveness,

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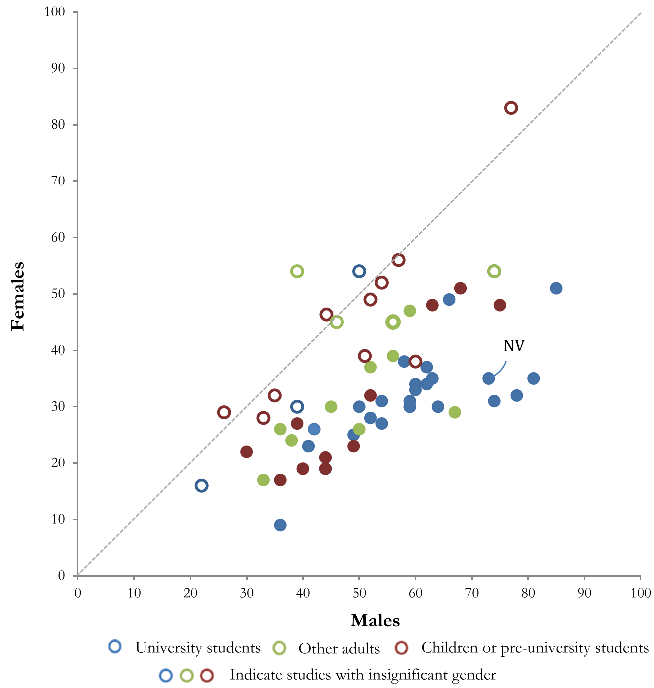

Fig. 1. Willingness to compete in studies using the Niederle-Vesterlund paradigm (percentage).
Note: The Fig. shows the ratio of males (x-axis) and females (y-axis) that chose to compete in previous studies on competitiveness. We have included experiments that were run with University students (blue), Other adults (green) and Children or pre-university students (red). The filled dots indicate significant gender differences, while unfilled dots indicate insignificant gender differences. For the full list of included studies, refer to Table A.1 in Appendix A. If men and women are equally competitive, then studies will report results along the 45-degree line. If women are less competitive, then studies will report results below the 45-degree line. The dot marked "NV" highlights the study of Niederle and Vesterlund (2007) that reported a significant gender gap. The Fig. shows that, across studies, it is a robust finding that adult females are less competitive than adult males. For children, the results are more mixed.

namely network of friends. Recent literature has explored how exposure to other women affects women's representation in male-dominated areas, such as engineering (Dasgupta et al. 2015), economics (Porter and Serra, 2020) and leadership positions (Yang et al. 2019). For example, Yang et al. (2019) show that female MBA students who have an inner circle of women have a higher expected job placement compared to females who do not have such an inner circle. The study by Yang et al. (2019) shows that having a network of other women matters in the labor market. Somewhat similarly, Modena et al. (2022) show that among Italian University students, high performing peers positively affect female students in particular. This effect is larger for female students when the high performing peer is female. We build on this work to see whether the composition of a child's friends is associated with a child's competitiveness. Even though the role of friends has been found to be important in relation to altruism (Leider et al., 2009) and favoritism (Belot and Van de Ven, 2011), to our knowledge, no papers have studied whether self-chosen friends are associated with competitiveness of children.

When understanding competitive choices, a central component is, of course, whether a subject should choose to compete to maximize profit. Niederle and Vesterlund (2007) already investigated this in their seminal article, and found that women compete too little, while men compete too much. With adolescents of 14-16 years old, Dreber et al. (2014) also find that girls compete too little in both a math task and a verbal task. We investigate this pattern across a large age-span from childhood to adolescence for both girls and boys.

Our results show that using non-parametric tests and even regressions with a large range of controls, there are no gender differences in competitiveness. However, among the above average performers who should compete, we find that girls are 11.8 percentage points less likely to compete when we control for individual ability, confidence, risk aversion, stereotypical beliefs, and interaction with the opposite gender. In addition, we investigate whether friends influence the decision to compete; we find that a girl is 9.6 percentage points more likely to enter the tournament if one more friend of hers competes. For boys, there is no effect of having a competitive friend in their network. For the above average performers, having friends who compete mitigates the gender gap as each competitive friend increases selection into competition by 5.6 percentage points. Finally, we compute the optimal decisions to enter the competition (or not) and we compare them with the observed decisions in our experiment. Our results show that boys become better at making the correct decision with age whereas girls avoid competition when they should choose it.

2. Related literature

Two pioneering studies have experimentally investigated competitiveness as one of the many explanations behind the gender gap. First, Gneezy et al. (2003) find that as an environment becomes more competitive, men increase their performance, while women do not. Second, Niederle and Vesterlund (2007) find that males compete significantly more than females, and these gender differences in competitiveness persist even when controlling for risk aversion, confidence, and aversion towards feedback about one's relative performance. Various experimental studies have replicated these findings and researchers have also focused their attention on children. For instance, Sutter and Glätzle-Rützler (2015) examine the competitive choices of 1, 570 Austrian children from early childhood to late teenage years and find that already at the age of three boys are more likely to compete than girls.

Fig. 1 compares the willingness to compete for males and females (adults and children) in experimental studies from 2007 to 2021. To create Fig. 1, we used all papers summarized by Dariel et al. (2017), who compiled a list of all studies that use the Niederle-Vesterlund (2007) paradigm[1], in the period from 2007-2018, and who report (or have informed about) entry-level decisions for females and males separately. If there are specific treatments, results from the control condition are reported. We updated the list with studies published since 2018 that used the Niederle-Vesterlund (2007) experimental paradigm. If men and women are equally competitive, then studies will report results along the 45-degree line. If women are less (more) competitive, then studies will report results below (above) the 45-degree line. Fig. 1 shows that most papers report results that fall below the 45-degree-line as most studies report that males are more competitive than females. Still, there is a substantial variation in the results.[2] The competition rate of adult women is between 9% (Cadsby et al., 2013) and 59% (Booth et al., 2019), and for adult men it is between 12% (Booth et al., 2019) and 85% (Dargnies, 2012). The study of Dariel et al. (2017) presents one of the few cases, where women compete significantly more than men. For

[1] The paradigm consists of stages that differ in how performance translates into earnings. In the first stage, participants are paid for each correct answer using a piece rate. In the second stage, each participant competes in a tournament against one (or more) randomly selected anonymous participants. The winner takes all: the participant with the highest performance receives the total payoff; the other(s) receive zero. The main measure of competitiveness is often in the third stage where the participants must choose between the piece rate and the tournament.

[2] 70% of all studies find significant gender differences, while for studies with children this Fig. is 52%. The full list of studies is included in Table A.1 in the Appendix.

children, the competition rate of girls is between 17% (Dreber et al., 2014) and 51% (Buser et al, 2017b), and for boys it is between 30% (Lee et al., 2014) and 75% (Zhang, 2018).

Studies on competitiveness have explored a number of reasons for the gender gap in competitiveness, such as confidence in the task, information, and the environment and network of girls and women. Below, we touch upon each of these channels and report the main findings.

If men are more (over)confident about their relative performance, one would expect them to enter competitive environments at a higher rate than women of equal performance. To investigate this, several papers elicit confidence, and vary the task. Kamas and Preston (2012) examine whether gender differences in willingness to compete are due to overconfidence. They let students solve both an addition task and a word search task: when asked about their beliefs, participants consider men better at the math task, and women better at the word task. Yet, the authors find women perform significantly better in the math task and marginally better in the word task. Interestingly, controlling for overconfidence eliminates the gender gap in the willingness to compete in the math task, where there is a significant gender gap in competitiveness. Dreber et al. (2014) ask Swedish high school students to perform both a math task and a word search task. They find girls and boys to be equally likely to self-select into the tournament in the verbal task, while boys are much more willing to enter the competitive setting in the math task. Controlling for actual performances and relative performance beliefs diminishes the gender gap in competitiveness, since girls are less confident about their performance in the math task than boys are. Wozniak et al. (2014) study how confidence affects tournament-entry, and find that when subjects are provided with information about the performances of others, the gender gap in competitive preferences disappears, which seems to suggest that lack of information creates confidence errors that may explain gender differences in economic outcomes. Similarly, Brandts et al. (2015) show that advice about the decision to enter competition increases the competitiveness of high performing women. Still, the advice treatment does not close the gender gap in competitiveness.

Gender differences in competitiveness may depend on the type of task used. Samek (2013) investigates gender differences in competitive preferences among preschool children who are matched randomly into pairs and take part in a gender-neutral fishing task that is performed under piece rates and tournament incentives, before choosing their preferred incentive scheme in stage 3. Contrary to the results reported in Sutter and Glätzle-Rützler (2015), the young boys and girls are equally willing to compete. Yet, the performances of girls under competitive incentives are significantly lower than those of boys. The children are very confident: 84% believe they are the winner and being paired with either a boy or a girl does not seem to matter. With children in Armenia aged 8 to 16, Khachatryan et al. (2015) study the willingness to compete in an addition task and a word search task and find no gender differences at any age across any of the two tasks.

In the labor market, gender stereotypes associated with a job or task could explain the under-representation of women in competitive environments (Akerlof and Kranton, 2000). If women perceive competitiveness as a male trait, they may feel subject to a conflict in their gender identity and feel pressured to act in a more feminine way to meet the expectations of their peers. Andersen et al. (2013) compare the competitive choices of children in matrilineal and patriarchal societies in India using a bucket toss task. Before performing the task, participants choose between piece rate pay and tournament pay. While the authors find no gender gap in competitiveness at any age in the matrilineal society, in the patriarchal society, boys become more competitive and girls less competitive around the age of puberty. Cárdenas et al. (2012) study the competitive performance and the willingness to compete of 1,200 children in Sweden and Colombia who perform in running, skipping rope, a math and a word search task. The results show no gender differences in tournament performance across the four tasks, and in Colombia, girls and boys are equally competitive in all tasks and measures, while boys are more willing to compete than girls in Sweden. Zhang (2018) shows that in China there is a smaller gender difference in competitiveness among paternalistic Han Chinese who have been exposed to gender equalizing reforms since 1950, compared to a larger gender difference among paternalistic Yi Chinese who were not exposed to these reforms. Importantly, there is only a difference in the competitiveness of women when comparing Han and Yi Chinese.

Last, a number of studies that do not exclusively use the Niederle and Vesterlund experimental paradigm investigate how the gender composition in the networks of women and men could matter. Booth and Nolen (2012) find that girls in single-sex schools in the UK are 42% more likely to compete compared to girls in coeducational schools, even when controlling for being placed in a mixed-gender experimental group. In fact, girls in single-sex schools behave in a manner similar to boys, also when competing in mixed-sex experimental groups. However, Lee et al. (2014) do not find the same results for girls attending a single-sex school in South Korea where girls are randomly assigned to a mixed or single-sex school. In the experiment all participants are allocated to mixed gender groups. Girls in single-sex schools are 15 percentage points less competitive than boys are and girls in coeducational schools are 8.4 percentage points less competitive than boys, but the differences in competitiveness between the two schooling systems is not significant. For women performing in a male dominated environment, Dasgupta et al. (2015) conduct an experiment among engineering students, where females are randomly placed in groups of either female minority, equality or majority. The results show that when females are in groups of female-equality or female-majority, they are less anxious about group work, they verbally take part more, and have higher career aspirations. Modena et al. (2022) show that high performing peers have a positive effect on other students –particularly for same gender peers. The larger effect from high performing females to other female students can be rationalized within theories about role models. Supporting this, Porter and Serra (2020) investigate role models and show that being exposed to a female role model can increase the number of females majoring in economics.

Leadership, top level and managerial positions are often associated with competitiveness (see, for example, Niederle & Vesterlund, 2007). Yang et al. (2019) analyze what kind of network predicts a leadership job placement for MBA students. Both high placing men and women are central in their networks. In addition, high placing women have a strong inner circle of other women, whereas men do not have a strong inner circle of men or women. The literature has not investigated whether children's self-chosen network of friends are associated with their competitiveness.

3. The experiment

One week before the experiment parents signed a consent form and filled in a questionnaire with some demographic variables (age, gender, number of siblings and their gender). For every questionnaire returned, we donated 25 DKK to the class account for social activities. We contacted 413 parents, and 353 parents gave us their consent (85.5%). However, our final sample comprises 338 children aged 7-16 (grades 1 to 9) because 13 questionnaires were not properly filled out and two children chose not to participate. The experiment took place during regular school hours in four different elementary schools: two private and two public. On the day of the experiment, we placed cardboard dividers on the tables and then randomly allocated children to seats. Once seated, we informed children that during the experiment, they had the opportunity to win *points* that later would be converted into gifts, such as small toys, games and schools materials, that are desirable for all participants across gender and age groups. We explained to the children that more points corresponded to more gifts, but we did not reveal the exact exchange rate (1 point = 0.40 DKK). We kept the exchange rate equal across all age-groups. Since, on average, older children built more rows, they also received more points on average. Information about the experimental procedures was revealed sequentially, immediately before the students performed each task. As suggested by the school principals, the instructions were given verbally, because of the level of literary among younger students and the time constraint of the sessions. The instructions were interactive and involved several examples and control questions to make sure that all participants understood the details of the different payment schemes. Of course, during the experiment we assisted children who needed help with the instructions.

In our experiment, children receive a box with 120 Lego bricks. They have 3 minutes to build as many rows as they can following specific instructions in terms of colors and sizes of the bricks (we use bricks in 2 different sizes and in 3 different colors). Following Niederle and Vesterlund (2007), children have a trial run and then they solve the task in three different stages. In the first stage, children receive 1 point per correct row (*piece-rate* scheme). In the second stage, they compete against an unknown child in their class. This means that if they build more rows than their opponent does, they receive 2 points per correct row, 0 points otherwise (*competitive* scheme). In the third stage, they can choose to perform the task under the *piece-rate* or *competitive* scheme. We do not inform children about their performance or payoff until the end of the experiment.

We carefully explained to the children that under the *competitive* scheme they are matched randomly with an anonymous child in the class: participant A competes against participant B, participant B against participant C, and so on. We randomly matched each child with the same opponent in stages 2 and 3, regardless of the other child's decision to compete. We follow the experimental design of Dreber et al. (2011) and adopt their circular matching: a child's decision to compete does not affect the payment of another child.

After the Lego task, we asked children to assess their (relative) performance. Children have to indicate both the total number of children taking part in that session and then their own rank within the class. For instance, in a class with 17 children taking part, children have to write "17" and then indicate their own ranking position, i.e., a number between 1 (best performer) and 17 (worst performer). We asked children to rank their performance for stage 2. On a different decision sheet, we asked them to guess the performance of two "real" children, a boy and a girl, depicted on a photo that shows them building a Lego wall.[3] We took these photos during the pre-test of our experiment and both these children built 11 correct rows within 3 minutes. This task allows us to elicit children's stereotypes, i.e., their belief about the performance of boys and girls.[4]

Moreover, we elicited children's risk preferences using a modified (and simpler) version of the Bomb Risk Elicitation Task (hereafter BRET) developed by Crosetto and Filippin (2013). Children must decide how many "steps" of a winding road (with 100 numbered steps) they want to walk across, knowing that one of the steps contains a "bomb". For each step they select, they receive 1 point; however, if one of the steps they select contains the bomb, they receive 0 points. After all children made their decision, we randomly determined the location of the bomb in front of the class. Finally, we elicited the network of friends in the class using the network elicitation task developed by Chen et al. (2016). We distributed a drawing of a table with six chairs. We asked children to write their own name above the chair at the head of the table and indicate, in order of preference, a maximum of five names of classmates who they would like to have seated at their table. We emphasized that nobody but the experimenters would see their answers.

At the end of the session, we called children individually to receive their *points* and to choose their gifts. Appendix B includes more detailed information about our experimental procedures, the script of our oral instructions, our decision sheets and some photos taken during the experiment.

For our power calculations, we take the unweighted average across all previous studies using children or pre-university subjects as reported in Dariel et al. (2017), resulting in 49% of the boys and 37% of the girls choosing to compete (clearly there is a lot of variability between the studies). Our sample size (164 boys and 174 girls) allows us to detect such a difference between boys and girls at the 5% level 99.99% of the time. If 37% of the girls choose to compete, we will detect a difference 80% of the time at the 5% level as long as boys are 4.9 percentage points more likely to compete.

4. Results

In our analysis, we divide our sample into three age groups: Grades 1-3 (aged 7-10), Grades 4-6 (aged 9-13), and Grades 7-9 (aged 12-16) according to the administrative division of grades in the Danish school system.[5] To test our hypotheses, we use the Mann-Whitney U test (hereafter MWW) and the Wilcoxon matched pairs Signed-Rank test (hereafter S-R).

Table 1 summarizes the average performances in the Lego task under the piece-rate (stage 1) and competitive scheme (stage 2), across age groups and genders. In stage 1 we find that older children perform significantly better than younger ones (MWW: Grades 1-3 vs. Grades 4-6, $p<0.001$; Grades 4-6 vs. Grades 7-9, $p<0.001$). Girls perform 9% better than boys (MWW, $p=0.0054$), but there is some variation with age (MWW: Grades 1-3, +12%, $p=0.034$; Grades 4-6, +2%, $p=0.52$; Grades 7-9, +15%; $p=0.005$). We observe a similar pattern for performance in stage 2 (MWW: All: +9%, $p=0.011$; Grades 1-3, +19%, $p=0.0019$; Grades 4-6, +3%, $p=$ 0.55; Grades 7-9, +13%; $p=0.06$). Overall, both girls and boys increase their performance under the competitive scheme (S-R: $p<0.001$). At all grade levels, both boys and girls significantly raise their average performance between the two stages (S-R: $p<0.001$) except for the youngest boys (S-R: $p=0.14$). Girls improve more in the younger grades, while boys improve slightly more in the older grades. Yet, there is no significant difference between the performance increase of boys and girls (MWW: $p=0.46$). In stage 3, boys are more likely to choose to compete than girls are (62% vs. 56%), but this difference is not significant (MWW: $p=0.27$). The difference between boys and girls in choosing to compete is not significant for children in Grades 1-3 (MWW: $p=0.88$) and in Grades 7-9 (MWW: $p=0.89$) and is marginally significant for the middle age group (MWW: Grades 4-6, $p=0.099$).

In our experiment, the more productive children should choose to compete more often. In our regression analysis, we control for the fact that girls are more "productive" than boys are. Moreover, three other factors may affect the willingness to compete: risk preferences, confidence, and stereotypical beliefs. In the Bomb Risk Elicitation Task, boys take significantly more steps than girls do (37.2 vs. 33.6, MWW: $p=0.018$), and comparing younger with older children, risk taking significantly increases with age for boys (MWW: $p=0.025$) and marginally significantly for girls (MWW: $p=0.052$). To control for confidence, we used children's guess about their relative performance ranks. We term a child as confident (confident=1) if the child believes that his or her performance in stage two lies in the top half of the distribution. Finally, we study children's stereotypical beliefs, i.e., their guesses about the performance of the boy and girl depicted in the photographs. Fig. 2 shows boys' (top panels) and girls' (bottom panels) guesses in combination with the smoothed distribution of the actual performances of boys and girls. Both boys' and girls' guesses of the girl's

[3] The two children were both in the 5th grade.

[4] The two photos were the same for all children. We chose the two photos to make the situation real for the participating children without highlighting the gender aspect of the comparison. We also wanted to avoid deception and we wanted the two children to be the same age. Only these two children from our pilot matched the description, and therefore we only showed these two photos.

[5] Dividing the sample into groups by age instead of grade does not significantly change our results.

Table 1
Performance in the Lego task in stages 1 and 2 and decision to compete in stage 3.

	Gender	N	Piece-rate - Stage 1 *(average #rows)*	Competitive - Stage 2 *(average #rows)*	Performance increase *(average #rows)*	Choosing to Compete *(mean percentage)*
Grades 1-3	Boys	49	7.76	8.18	0.43	0.53
	Girls	60	8.68	9.70	1.02	0.52
	Total	109	8.27	9.02	0.75	0.52
Grades 4-6	Boys	67	9.96	11.46	1.51	0.70
	Girls	54	10.19	11.83	1.65	0.56
	Total	121	10.06	11.63	1.57	0.64
Grades 7-9	Boys	48	10.75	12.79	2.04	0.60
	Girls	60	12.32	13.87	1.55	0.62
	Total	108	11.62	13.39	1.77	0.64
All	Boys	164	9.53	10.87	1.34	0.62
	Girls	174	10.40	11.80	1.40	0.56
	Total	338	9.97	11.35	1.37	0.59

performance (on the right) are precise. Whereas, both boys' and girls' guesses of the boy's performance (on the left) are more right-skewed, meaning that guesses of boy's performance are much higher than the actual performance of boys. The percentage of girls who believe that the boy is better increases with age (Grades 1-3, 55% vs. Grades 4-6, 63% vs. Grades 7-9, 72%, Cuzicks test for trends: p=0. 059), while the opposite is true for boys (Grades 1-3, 78% vs. Grades 4-6, 66% vs. Grades 7-9, 58%, Cuzicks test for trends: p=0.038). This result shows that for girls, the stereotype of high male performance in the task becomes more pronounced with age, which suggests that for girls the stereotypical belief is developing with age[6]. We incorporate this insight into our regression analysis by using the difference between the number of rows guessed for the boy and the girl. If the parameter estimate is positive, it suggests that a stereotypical view that boys are better at the task affects the decision to compete.

In Table 2, we present the results from a probit regression on the decision to enter the tournament in stage 3. To ease the interpretation of the regression results; we report the marginal effects estimated at the mean. Our model (1) mirrors the non-parametric tests and does not include any controls. This shows again, that the difference in competiveness between boys and girls is insignificant, as the "Female" variable is insignificant (p=0.35). In model (2) we add all over controls, and even though the estimate on "Female" increases fourfold in absolute terms, the variable remains insignificant (p=0.11). In model (2), the significant regressors are performance in Stage 2 (p=0.02), the number of competing friend (p=0.01), and number of siblings (p=0.008*)*. These results implies that for each extra row build the probability of choosing the competitive incentive increases by 3.8 percentage points, that each extra competitive friend increases the probability of choosing the competitive incentive by 5 percentage points, and that one more sibling increases the probability of competing by 5.3 percentage points. We control for the number of friends of a different gender, to show that the result is not reflecting that some girls are having many male friends and vice versa. We do not find a significant effect of risk taking on the probability of entering the tournament (p=0.24), and no significant effect of being confident (p=0.34), or believing the stereotype of the boy is best (p=0.65). In models (3) and (4) we run our model separately for boys and girls. We find that the effect of the "number of competing friends" variable comes from girls. For boys, in model (3), the significant predictors for choosing the competitive incentive is performance in stage 2 (p=0.06), and the number of siblings (p=0.04). Whereas for girls, in model (4), the only significant predictor is that each competitive friend significantly increases the probability of choosing the competitive incentives by 9.6 percentage points (p<0.01). How to interpret this result? Consider two girls who are similar in all respects, including the gender of their friends. The only difference is the number of competitive friends: one girl has two competitive friends and the other has three competitive friends. Our result implies that the latter is 9.6 percentage points more likely to choose the competitive incentive.

In models (5) and (6), we split the sample by the children's average performance in stage 2. [7] In model (5) we see that girls performing above average are 11.8 percentage points less likely to choose the competitive incentive (p=0.046). All things being equal, above average performers should select into competition to maximize their payoff, but girls are less likely than boys to do so. The number of friends who compete has a significantly positive effect on the willingness to compete (p< 0.01) for above average performers, meaning that having one more friend who selects competition raises the probability of entering the competition by 5.6 percentage points (p < 0.01). As we are already looking at the top performers, performance in stage 2 has no significant effect on the choice to compete. In model (6), for children performing below average, we do not find any gender differences in the choice of competitive incentives nor any effect of competitive friends. For the group of children below average, confidence increases the probability of choosing the competitive incentive by 17.4 percentage points (p=0.041), and the number of siblings.

Our initial exploration in regression models (2) through (6) suggests that networks of friends seem to be associated with competitiveness. To shed light on the effect other children have on the individual decision to compete, we define and explore three levels of peers: First, the "inner circle" consists of friends. These are the friends that children indicate in our network elicitation. Second, the "cluster" consists of other children in the class that are connected by at least one other child. Third, the "entire class". To find out how these three levels of peers affect the competitiveness, we start by exploring the clusters in the class, by making a network of friends based on the network elicitation task. In Fig. 3 we present three different attributes that children can potentially cluster on. In panel (a) in Fig. 3 we present the gender aspect, and show that children cluster based on gender, i.e., boys (girls) are mainly friends with boys (girls). In our panel (b) we instead present the performance of children as being above or below the average performance in their class. From a visual inspection, there is no clear clustering on performance. Last, in panel (c), we present competitiveness in stage 3. Again there is no clear clustering on competitiveness. In sum, from a visual inspection of the network of friends in class, children do cluster on gender, but do

[6] We find no significant difference in stereotypical beliefs for girls above and below average performance, a division of the observations into subgroups that we will use in Table 2, models (6) and (7).

[7] We get similar results when dividing the sample by *above* or *below median performance* in the class.

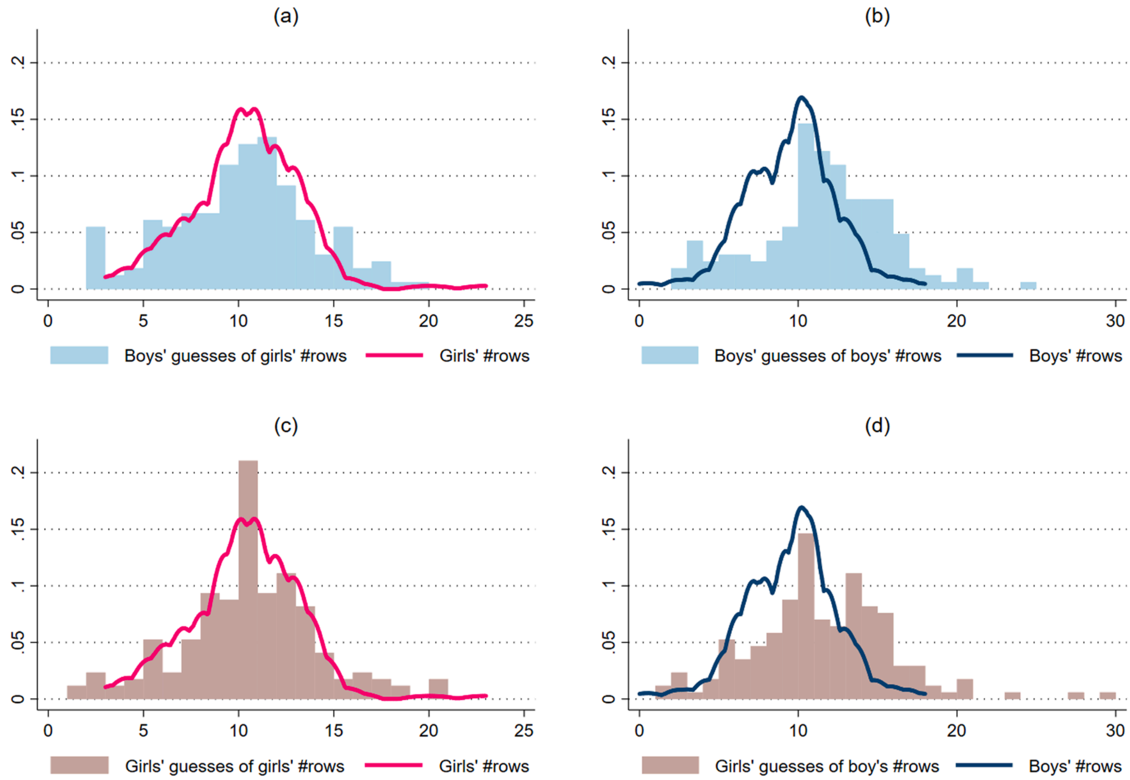

Fig. 2. Beliefs about the performance vs actual performance.

Note: The Fig. shows the number of Lego rows that boys and girls, respectively, expect a boy and a girl to have built, compared with the distribution of the number of rows the boys and girls actually built.

Table 2

Marginal Effects on the Probability of Choosing the Competitive Compensation Scheme.

		Dependent variable: Choice of competitive payment scheme				
	(1)	(2)	(3)	(4)	(5)	(6)
Female (=1)	-0.059	-0.079			-0.118**	-0.036
	(0.063)	(0.049)			(0.059)	(0.090)
Performance in stage 2		0.038**	0.039*	0.032	0.042	-0.004
		(0.017)	(0.021)	(0.026)	(0.033)	(0.031)
Risk taking (# steps)		0.003	0.004	0.002	0.003	0.003
		(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Number of competing friends		0.050**	-0.001	0.096***	0.056***	0.037
		(0.020)	(0.051)	(0.033)	(0.021)	(0.040)
Confident (=1)		0.066	0.083	0.056	-0.097	0.174**
		(0.070)	(0.112)	(0.077)	(0.103)	(0.085)
Stereotype (boy is best, difference in # rows)		-0.005	0.012	-0.025	-0.006	-0.004
		(0.012)	(0.011)	(0.016)	(0.015)	(0.014)
Number of siblings		0.053***	0.068**	0.040	0.029	0.056**
		(0.020)	(0.033)	(0.036)	(0.038)	(0.027)
Sample	All	All	Males	Females	Above average	Below average
Controls	No	Yes	Yes	Yes	Yes	Yes
Observations	338	338	164	174	168	170
R-squared	0.003	0.072	0.079	0.089	0.072	0.056

Note: The dependent variable of the probit regression is equal to 1 if the participant chose the competitive incentive in Stage 3. The included controls are: The continuous variables; 'Grade', 'Average number of rows built in stage 2 in the class, excluding the subject, *i* ', 'Number of opposite gender friends'. All control variables are insignificant in all models. The full table can be found in Appendix A, Table A2. Robust standard errors clustered by class are in parentheses. We run our preferred model 2 with males and females, separately in column (3) for males and in column (4) for females. In columns (5) and (6) the participants are split by their *actual* performance in stage 2; we run a regression for the children performing above the class average (excluding the individual) in column (5) and below in column (6). The number of girls above average is 98 (out of 168) and the number of girls below average is 76 (out of 170).

*$p<0.1$, **$p<0.05$, ***$p<0.01$.

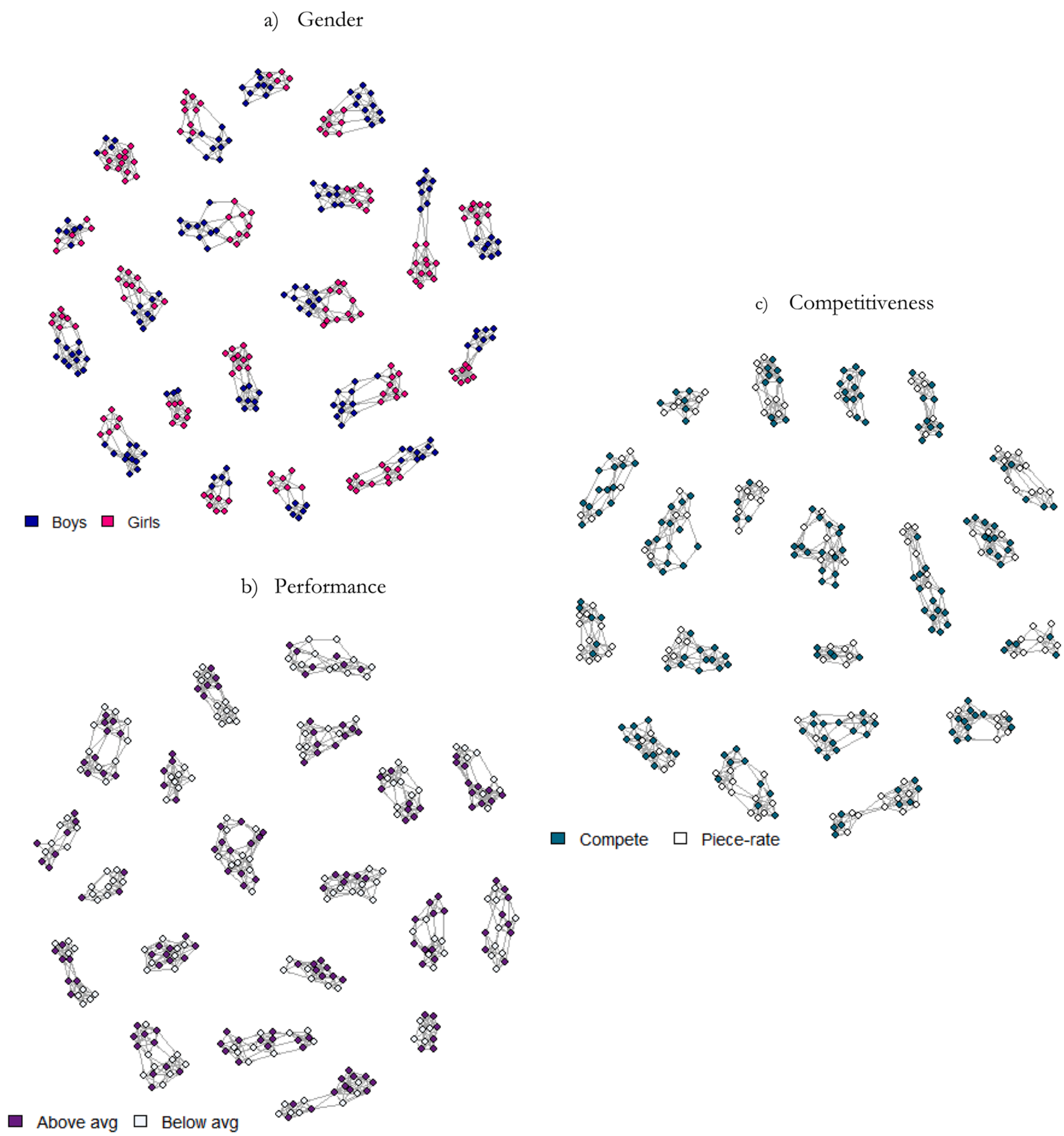

Fig. 3. Children's connections within each class.
Note: The Fig. above shows ties between children as reported in the friend elicitation task. Each class is a separate cluster because children can only indicate peers from their class as friends. In the three panels, we show children's network of friends according to gender (panel a), whether they perform above or below average (panel b), and their choice to compete (panel c).

not cluster based on performance or competitiveness. This result shows that the effect on competitiveness from having one extra competitive friend does not seem to stem from belonging to cliques of high competitors: rather it seems to come from having one more competitive friend.

Next, we focus on the largest group of peers (the class) and the smallest group (the inner circle of friends) by asking how the competitiveness of a class is associated with the competitiveness of the child and the competitiveness of the friends. We use the specification from Model 2 and add a dummy equal to 1 if the percentage of competitors in the class is higher or equal to 50% (excluding the child). We also transform the number of competitive friends into a dummy which equals 1 if more than 3 friends are competitive. This specification allows us to study the interaction between being female and having a majority of competitive friends, while controlling for the effect of being in a competitive class. Note that our regressions do not report the marginal effects because they are not interpretable when using interaction terms: instead, we show predictions of entering the competition at different values for model (9). The results of model (7), show that being in a competitive class, is significantly associated with choosing the competitive incentive (*p*

Table 3
Choice of Compensation Scheme and children's inner circle of friends and class.

	Dependent variable: Choice of competitive payment scheme		
	(7)	(8)	(9)
Female (=1)	-0.227	-0.224	-0.674***
	(0.147)	(0.140)	(0.190)
Most friends are competitive (=1)		0.128	-0.301
		(0.255)	(0.348)
Female (=1) # Most friends are competitive (=1)			0.833**
			(0.335)
At least 50% of class competes (=1)	0.662***	0.599**	0.593**
	(0.202)	(0.300)	(0.297)
	Predictions at the mean: Probability of choosing competition		
Males # Most friends are competitive (=0)			0.709***
Males # Most friends are competitive (=1)			0.598***
Females # Most friends are competitive (=0)			0.450***
Females # Most friends are competitive (=1)			0.658***
Sample	All	All	All
Controls	Yes	Yes	Yes
Observations	338	338	338
R^2	0.105	0.106	0.124

Note: The dependent variable of the probit regression is equal to 1 if the participant chose tournament incentives in Stage 3. We use the same controls as in model 2, Table A3: The continuous variables; "Performance in stage 2", "Risk taking", 'Grade', 'Average number of rows built in stage 2 in the class, excluding the subject, i ', 'Number of opposite gender friends' and 'Number of siblings', and the dummies; 'Confident in stage 2 (=1)', and 'Boy is best' (=1). Robust standard errors clustered by class are in parentheses. The full Table can be found in Appendix A, Table A.3. The variables "At least 50% of class competes (=1)" and "Most friends are competitive (=1)" are correlated, however, the parameter estimates on (Female (=1) # Most friends are competitive (=1)=0.83; p=0.013) remains almost unchanged if we remove the variable dummy "At least 50% of class competes (=1)". $^*p<0.1$, $^{**}p<0.05$, $^{***}p<0.01$.

=0.105). In model (8) we introduce the dummy for *most friends are competitive,* which is not significant, whereas the effect from being in a competitive class is almost unchanged. However, as seen in Table 2, this variable should only matter for girls. To test this hypothesis alongside testing the effect of being in a competitive class, we add an interaction term between having 3 or more competitive friends and being female in model (9). Model (9) shows that girls with three or more competitors in their circle of five friends are more competitive than girls with fewer than three competitors (Female (=1) # Most friends are competitive (=1); p =0.013), when controlling for being in a competitive class. The female dummy is now significant and negative and the dummy for being in a competitive class is significant and positive. Further, we investigate the predictions from model (9) separately for boys and girls and the two values of the dummy "most friends are competitive". The results, in the bottom part of Table 3, show that the predicted probability of choosing the competition is 20.8 percentage points higher for girls that have 3 or more competitive friends, compared to girls that have less than 3 competitive friends. For boys there is instead a decrease of 11.1 percentage points in predicted competitiveness. In summary, our results suggest that a competitive "class" increases children's competitiveness. Controlling for this competitive "class" effect, we still find a positive effect of the inner circle of friends, as having more competitive friends is associated with being more competitive. This effect is greater for girls.

Finally, we investigate whether children make the optimal decision in stage 3. Since we randomly matched the children, a child should choose to compete if his or her performance is above the average performance in the class. Fig. 4 shows that older boys make significantly more correct decisions than younger boys (51% vs. 58% vs. 71%, Cuzicks test for trends: p=0.048), while older girls make fewer correct decisions than younger girls (67% vs. 59% vs. 50%, Cuzicks test for trends: p=0.065). Among younger children, girls do not make significantly more correct decisions than boys (MWW: p=0.14), even if younger boys make more wrong decisions to compete when they should not, compared to girls (MWW: p=0.016). Among the oldest children, boys are significantly better than girls at making the correct decision (MWW: p=0.045), and more girls than boys avoid the competition when they should choose it (MWW: p=0.07). For investigating this pattern, we run an exploratory analysis in which we regress our measures of stereotype, risk preferences and confidence on the propensity to make correct decisions using a probit model (for the full set of results, see Appendix Table A1). For girls, we find that none of our measures have explanatory power, but for boys we observe that believing the boy is better at the task is associated with making more correct decisions.

5. Conclusion

We conducted an experiment using an intuitive and novel real-effort task customized for children. We find that Danish boys are not more willing to compete than Danish girls when looking at our full sample both non-parametrically and when using controls. However, when we focus on children performing above the class average, who should choose to compete, girls are 11.9 percentage points less likely to choose to compete when controlling for individual ability (girls in our task are more productive than boys), confidence (boys, especially if young, are more confident than girls), risk taking (boys are more risk taking than girls), stereotypical beliefs (both boys and girls think boys are more productive), having siblings and having friends of the opposite gender. We then investigate the network of friends and we find that girls are 9.6 percentage points more likely to enter the tournament if one more of their friends is competitive. We also find a strong effect of being in a competitive class, where the norm of behavior in the class is strongly associated with children's decisions to compete. For both girls and boys, we find a positive association between the competitiveness of their friends and their own competitiveness, even when controlling for the competitiveness of the class. The effect is almost twice as big for girls than for boys. The effect does not come from children forming clusters of competitive or non-competitive children: but, rather from both class-culture and having a majority of competitive friends.

We believe that a deeper analysis of the effect that peers have on the decision to compete is crucial both for public policy and future research:

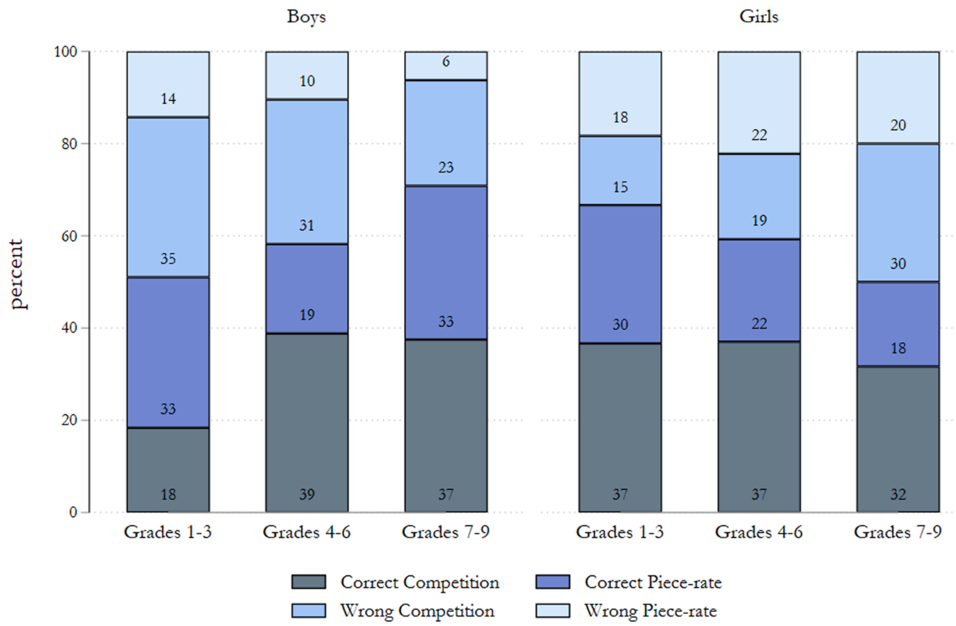

Fig. 4. Correct and wrong decisions in stage 3 (percentage).
Note: A child should enter the competition if his or her performance is above the average performance in class. The Fig. shows the fraction of children who correctly or wrongly chose piece-rate or competitive incentives by gender and age group.

Being exposed to a (more) competitive environment may be beneficial for increasing the competitiveness of girls and boys alike. But for girls who have competitive friends among their inner circle, the effect is much larger. This result is consistent with the newest evidence in the literature showing that among female university students: if exposed or connected to (other) females, women get better grades, have higher chance to graduate, develop higher career aspirations and obtain better jobs (Dasgupta et al., 2015; Porter and Serra, 2020; Yang et al., 2019 and Modena et al., 2022).

Data availability

Data is available as Data in Brief

Appendix A. Additional tables and Figs.

(Fig A1, Table A1, A2, A3, A4)

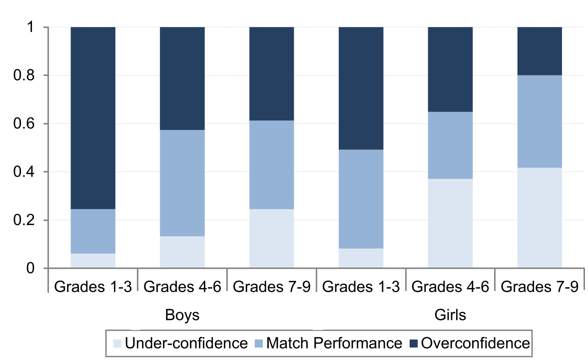

Fig. A1. Under- and overconfidence by gender and age group.
Note: Comparing children's guessed rank with their actual performance, the Fig. shows the proportion of children who are overconfident, under-confident, or match their performance by gender and age group.

Table A1
List of studies using the Niederle-Vesterlund (2007) design in Fig. 1.

Study	Sample size	Task	% selecting competition		
			Male	Female	Significance
Niederle and Vesterlund (2007)	80	Addition	73	35	Yes
Gneezy, Leonard, and List (2009)	74	Bucket toss	50	26	Yes
	74	Bucket toss	39	54	No
Cason, Masters and Sheremeta (2010)	69	Addition	56	45	Yes
Dohmen and Falk (2011)	360	Addition	62	37	Yes
Healy and Pate (2011)	192	Addition	81	35	Yes
Balafoutas and Sutter (2012)	72	Addition	64	30	Yes
Balafoutas, Kerschbamer, and Sutter (2012)	132	Addition	59	31	Yes
Cárdenas et al. (2012)	304	Math search	44	19	Yes
	304	Word search	39	27	Yes
	315	Math search	35	32	No
	316	Word search	26	29	No
Dargnies (2012)	76	Addition	85	51	Yes
Kamas and Preston (2012)	310	Addition	41	23	Yes
Mayr et al. (2012)	543	Addition	56	39	Yes
Mueller and Schwieren (2012)	127	Addition	42	26	No
Price (2012)	310	Addition	66	49	Yes
Shurchkov (2012)	128	Verbal	39	30	No
	84	Match puzzles	44	19	Yes
Andersen et al. (2013)	172	Bucket toss	52	49	No
	146	Bucket toss	51	39	No
Cadsby Servátka, and Song (2013)	132	Addition	36	9	Yes
Datta Gupta, Poulsen, and Villeval (2013)	100	Mazes	60	34	Yes
Niederle, Segal, and Vesterlund (2013)	84	Addition	74	31	Yes
Samak (2013)	123	Fishing task	77	83	No
Buser, Niederle, and Oosterbeek (2014)	362	Addition	49	23	yes
Dreber, von Essen, and Ranehill (2014)	216	Addition	36	17	Yes
	216	Word search	33	28	No
Lee, Niederle, and Kang (2014)	640	Addition	30	22	Yes
Brandts, Groenert, and Rott (2015)	89	Addition	59	30	Yes
Wozniak, Harbaugh, and Mayr (2014)	128	Addition	54	31	Yes
	128	Verbal	50	30	Yes
Apicella and Dreber (2015)	191	Skipping rope	45	30	Yes
	88	Bead collection	52	37	Yes
	70	Handgrip strength	67	29	Yes
Khachatryan et al. (2015)	824	Addition	54	52	No
	824	Word search	57	56	No
Masclet, Peterle, and Larribeau (2015)	202	Decoding	62	34	Yes
Reuben, Sapienza, and Zingales (2015)	409	Addition	60	33	Yes
Sutter and Glätzle-Rützler (2015)	717	Addition	40	19	Yes
Almås et al. (2016)	483	Addition	52	32	Yes
Berlin and Dargnies (2016)	228	Addition	63	35	Yes
Cassar, Wordofa, and Zhang (2016)	358	Addition	36	26	Yes
Sutter et al. (2016)	246	Addition	44	21	Yes
Apicella, Demiral, and Möllerström (2017)	100	Addition	58	38	Yes
Buser, Dreber, and Möllerström (2017)	104	Addition	52	28	Yes
Buser, Peter, and Wolter (2017)	249	Addition	68	51	Yes
Dariel et al. (2017)	147	Addition	50	54	No
Halko and Sääksvuori (2017)	80	Addition	74	54	No
Balafoutas, Fornwagner and Sutter (2018)	144	Addition	40	13	Yes
Banerjee, Gupta, and Villeval (2018)	168	Memory task	22	16	No
Buser, Gerhards, and van der Weele (2018)	297	Mix	42	26	Yes
Bönte, Procher, and Urbig (2018)	225	Math	56	45	No
Flory et al. (2018)	730	Arranging shapes	46	45	No
Khadjavi and Nicklish (2018)	84	Running task	44	46	No
Saccardo, Pietrasz, and Gneezy (2018)	126	Ball-tossing	78	32	Yes
Zhang (2018)	96	Addition	60	38	No
	80	Addition	75	48	Yes
	96	Addition	63	48	Yes
Booth, Fan, Meng and Zhang (2019)	98	Addition	12	26	Yes
	117	Addition	45	26	Yes
	119	Addition	47	45	No
	131	Addition	51	42	No
	118	Addition	54	45	No
	110	Addition	57	59	No
Zhong et al. (2018)	197	Addition	49	25	Yes
Barrymore, Dezsö and King (2022)	291	Counting task	44	30	Yes
Buser et al. (2021)	1132	Ball-tossing	38	24	Yes
	571	Counting task	59	47	Yes
	1980	Counting task	33	17	Yes

Table A.2
Marginal effects of choosing the competitive payment scheme, all covariates.

	Dependent variable: Choice of competitive payment scheme (1)	(2)	(3)	(4)	(5)	(6)
Female (=1)	-0.059	-0.079			-0.118**	-0.036
	(0.063)	(0.049)			(0.059)	(0.090)
Performance in stage 2		0.038**	0.039*	0.032	0.042	-0.004
		(0.017)	(0.021)	(0.026)	(0.033)	(0.031)
Risk taking (# steps)		0.003	0.004	0.002	0.003	0.003
		(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Number of competing		0.050**	-0.001	0.096***	0.056***	0.037
friends		(0.020)	(0.051)	(0.033)	(0.021)	(0.040)
Confident (=1)		0.066	0.083	0.056	-0.097	0.174**
		(0.070)	(0.112)	(0.077)	(0.103)	(0.085)
Stereotype (boy is best,		-0.005	0.012	-0.025	-0.006	-0.004
difference in # rows)		(0.012)	(0.011)	(0.016)	(0.015)	(0.014)
Number of siblings		0.053***	0.068**	0.040	0.029	0.056**
		(0.020)	(0.033)	(0.036)	(0.038)	(0.027)
Average number of rows in class		-0.033	-0.038	-0.026	0.005	-0.037
(excluding the individual)		(0.058)	(0.098)	(0.056)	(0.049)	(0.080)
Number of friends with		0.020	0.023	0.012	0.018	0.027
Opposite gender		(0.023)	(0.042)	(0.039)	(0.050)	(0.034)
Grade		0.005	0.009	0.009	-0.035	0.048
		(0.046)	(0.067)	(0.056)	(0.040)	(0.059)
Sample	All	All	Males	Females	Above average	Below average
Controls	No	Yes	Yes	Yes	Yes	Yes
Observations	338	338	164	174	168	170
R^2	0.003	0.072	0.079	0.089	0.072	0.056

Note: The dependent variable of the probit regression is equal to 1 if the participant chose tournament incentives in Stage 3. Robust standard errors clustered by class are in parentheses. The participants are divided into two groups, males and females, with the corresponding regression results in column (3) for males and in column (4) for females. In columns (5) and (6) the participants are split by their *actual* average performance in stage 2; we run a regression for the children performing above average in column (5) and below in column (6). The number of girls who are above average is 98 (out of 168) and the number of girls below average is 76 (out of 170). $^*p<0.1$, $^{**}p<0.05$, $^{***}p<0.01$.

Table A3
Probit regression with interaction terms, all covariates.

	Dependent variable: Choice of competitive payment scheme (7)	(8)	(9)
Female (=1)	-0.227	-0.224	-0.674***
	(0.147)	(0.140)	(0.190)
Most friends are competitive (=1)		0.128	-0.301
		(0.255)	(0.348)
Female (=1) # Most friends are competitive (=1)			0.833**
			(0.335)
At least 50% of class competes (=1)	0.662***	0.599**	0.593**
	(0.202)	(0.300)	(0.297)
Performance in stage 2	0.109**	0.108**	0.100**
	(0.044)	(0.044)	(0.046)
Risk taking (# steps)	0.008	0.008	0.008
	(0.006)	(0.006)	(0.006)
Confident (=1)	0.228	0.226	0.267
	(0.186)	(0.188)	(0.192)
Stereotype (boy is best,	-0.014	-0.017	-0.019
difference in # rows)	(0.030)	(0.031)	(0.029)
Number of siblings	0.146***	0.144***	0.138***
	(0.054)	(0.054)	(0.052)
Average number of rows in class	-0.082	-0.079	-0.056
(excluding the individual)	(0.097)	(0.095)	(0.103)
Number of friends with	0.086	0.078	0.084
opposite gender	(0.075)	(0.079)	(0.082)
Grade	-0.021	-0.022	-0.027
	(0.064)	(0.062)	(0.071)
Constant	-0.959	-1.002	-0.916
	(0.685)	(0.666)	(0.668)
Sample	All	All	All
Observations	338	338	338
R^2	0.105	0.106	0.124

Note: The dependent variable of the probit regression is equal to 1 if the participant chose tournament incentives in Stage 3. Robust standard errors clustered by class are in parentheses. The participants are divided into two groups, males and females, with the corresponding regression results in column (3) for males and in column (4) for females. In columns (5) and (6) the participants are split by their *actual* average performance in stage 2; we run a regression for the children performing above average in column (5) and below in column (6). The number of girls who are above average is 98 (out of 168) and the number of girls below average is 76 (out of 170). $^*p<0.1$, $^{**}p<0.05$, $^{***}p<0.01$.

Table A4
Explorative analysis of correct decisions.

	Dependent variable; Making the correct decision in Stage 3		
	(1)	(2)	(3)
Risk taking (# steps)	-0.001	0.006	-0.006
	-0.003	-0.007	-0.004
Confident (=1)	-0.081	0.132	-0.348
	(0.197)	(0.243)	(0.294)
Stereotype (boy is best,	0.012	0.031	-0.006
difference in # rows)	-0.022	-0.024	-0.03
Class	-0.005	0.073	-0.0711*
	-0.033	-0.053	-0.042
Constant	0.315	-0.458	1.017***
	(0.290)	(0.429)	(0.372)
Sample	All	Males	Females
Observations	338	164	174
R^2	0.001	0.023	0.028

Note: The dependent variable of the probit regression is equal to 1 if the participant chose tournament incentives in Stage 3. Robust standard errors clustered by class are in parentheses. The participants are divided into two groups, males and females, with the corresponding regression results in column (2) for males and in column (3) for females.
*$p<0.1$, **$p<0.05$, ***$p<0.01$.

Appendix B. Preparations, prizes and task

Our experiment is a part of the project "KIDS" at the University of Copenhagen. The KIDS project has IRB approval from The Institutional Ethical Review Board at the Department of Psychology, University of Copenhagen (Approval numbers: 2015/12 and 2016/B04). We obtained consent from school principals and parents (signed a consent form) agreeing to take part in our study aimed at investigating children's economic decision making. We informed the children that it was voluntary for them to participate, and that they could withdraw at any time. We never mentioned gender issues to schools, parents or children. The experiment took place during regular school hours in four different elementary schools: two private and two public. Information about the experimental procedures was revealed sequentially, immediately before the students performed each task. The instructions were given verbally, as suggested by the school principals, because of the level of literary among younger students and the time constraint of the sessions. The instructions were interactive and involved several examples and control questions to make sure that all participants understood the details of the different payment schemes.

Prizes

We used small gifts rather than money to make the comparisons of rewards less salient among the participants, as suggested in Krause and Harbaugh (1999). To find appropriate gifts and to test the Lego task, we conducted a pilot with 30 children at the after school program "Dronen" and at Experimentarium City in October, 2015 with children aged 8 to 11, which corresponds to grades 3 to 5. We carried out a small "market research" when doing these pilot studies, and children assessed different items, such as toys, small games and school supplies, to investigate how popular the items were among children their age. We selected the rewards for the actual experiment based on their opinions and suggestions to make sure the participants' incentives were salient enough.

Lego task

We used a task based on Lego because most children in Denmark are familiar with Lego building blocks and Lego instructions. Globally, Lego was proclaimed to be one of the few gender-neutral toys on the market until recent years (Gebreyes, 2015). Thus, we created the Lego task to be a gender-neutral task both with respect to how the task would be perceived, and to ensure boys' and girls' equal ability to build with Lego. Further, Lego is recognized as a toy, which makes it fun for children to participate, and this helps ensure the children's attention throughout the experiment. We kept the level of difficulty constant across ages, and older children were expected to perform better on average, providing them with higher payoffs to match the age variability in children's pocket money and ensuring their motivation. We constructed Lego wall checker sheets from overhead projector plastic sheets, so that instead of checking individually that every row of a Lego brick wall was built with the correct Lego bricks, it was possible to place the Lego checker sheets on top of the Lego construction and immediately tell whether the rows were built according to the instructions. In case of mistakes, the bricks change colors on the sheets, as shown in the below(Fig B.1, B.2, B.3, B.4).

Fig. B.1. The Lego brick walls with laminated plans.

Fig. B.2. Children performing the Lego task (blurred for privacy reasons).

Fig. B.3. Lego wall and transparent checker sheets.

Fig. B.4. Rewards - "The experiment shop".

Appendix C. Experimental procedures

Demographic questionnaire

A week before the experiment, parents receive a letter with an invitation to take part in the project along with a consent form. Parents of children participating in the experiment are asked to sign the consent form and fill out a demographic questionnaire.

Subjects and the settings

The participants in the experiment are children aged 7 to 16, corresponding to grades 1-9 of lower and middle school. The experiment is carried out in the classroom, and the children are randomly assigned new seats when they enter the room before the experiment begins. They draw a laminated number, and the experimenter directs the participant to his or her seat. Test dividers made out of cardboard are placed on the tables so the participant can make his or her decisions in private. More space around the individual participant is created by rearranging the tables and the chairs in the classroom. On the table in front of each participant, there is a box of Lego bricks, a pen and four decision sheets pinned together with a paper clip and faced downwards. To motivate the participants' performance in the economic games, the experimenters begin the sessions by showing them some of the toys, games, and school materials that they can buy with the points they earn in the games. The teacher is always present in the classroom to observe the experimental proceedings, and he or she is informed about the decision games beforehand. The teacher is asked not to discuss the games with the children; the experimenters will instead assist the participants if they have any questions. While experimenter 1 begins to explain the instructions for the Lego game, experimenter 2 enters the names of the participants next to their drawn number in a pre-prepared Excel sheet.

Script

"Welcome to our experiment. Together we will play three games. In every game, you have the opportunity to earn points that you can later spend in our Experiment Shop. With your points, you can buy small toys, games, and school materials. More points mean more prizes. Your decisions in the games are private and no one will know how many points you have earned in the games - not your classmates or your teacher - unless you tell them yourself. We will now explain the rules of the first game. Pay careful attention to these instructions, because the better you understand them, the more points you can earn. Please do not talk to each other from this point on. If you have a question, please raise your hand and ask. Otherwise, we urge you to be quiet and listen carefully just like you normally listen to your teacher in school."

Task 1: The Lego Task.

"In front you on the table there are a pen and some sheets of paper. Do not touch that for now, we will explain about them later. Instead, focus on the box of Lego bricks. Inside you will find some bricks of different shapes and colors and three base plates. There is also a laminated drawing of a wall made of Lego bricks with three rows. Try to see whether you can replicate the Lego wall. It has to be built exactly as it is on the plan. Once you have finished, place the Lego wall in front of you so that we can check that it is built correctly." The participants now have 1-2 minutes to build the wall (Test). The two experimenters go around and check that the participants have understood the task. The experimenter praises the participants: "Good job! This was just a practice. Now you have to separate all the bricks and put them back in the box. None of them must stick together." In the meantime, the two experimenters place a set of the first three laminated plans (1A, 1B, 1C) upside-down on the table next to each participant. "Don't look at this before we tell you to." Experimenter 1 addresses the whole class: "Now we begin the first part of the Lego game. In front of you, there are three plans of different Lego walls. Each wall now has ten rows, while before it was only three rows. We will give you three minutes to build as many rows as you can. For each row correctly built, you will receive 1 point. If you finish more than the ten rows of a wall, you just start a new wall with one of the other plans. Afterwards we will count the number of correctly built rows. Have you understood the task? Do you have any questions? Let us try an example: If Johan builds a Lego wall with five rows, how many points does he get? Five, yes that is correct. Now I will set the countdown clock. Are you ready? Ready, set, go build!"

"..3, 2, 1, now the time is up! Stop building and do not touch the Lego bricks. We will now come and check your Lego walls. The experimenters use the plastic checker sheets, and write down the number of correctly built rows on each participant's Lego decision sheet. "Good job all of you! Now you have to separate all the bricks and put them back in the box again. None of them must stick to together." The experimenters go around and replace the old Lego plans with new ones (2A, 2B, 2C) for the second part of the Lego game. The plans are again placed upside down on the table. "Now we are ready for the second part of the Lego game. Again, you have plans of Lego walls in front of you, and as before, you will be given 3 minutes to build as many rows as you can, BUT this time it is a competition. Each of you is matched with another person in this room. This was done randomly, when you entered the room and picked a number. We will not tell you who you are competing with. If you build more rows than your opponent does, you win the competition and you will receive 2 points per row you correctly built. However, if you finish fewer rows than your opponent does, you lose and you will get zero points. If you finish the same number of rows as your opponent, you get 1 point per row. Let us try an example. If Johan builds five rows and his opponent builds four rows, how many points does he get? Yes, he wins, and he receives 10 points. What if his opponent builds five rows? Then he gets 5 points. What if his opponent finishes six rows? Yes, he loses and gets zero points. Do you have any questions? Okay, I will set the countdown clock. Are you ready? Ready, set, go build!"

"..3, 2, 1, now the time is up! Stop building and do not touch the Lego bricks. We will now come and check your Lego walls." The experimenters use the plastic checker sheets, and write down the number of correctly built rows on each participant's Lego decision sheet. "Good job all of you! Now you have to separate all the bricks and put them back in the box as you did before. None of them must stick together." The experimenters go around and replace the old Lego plans with new ones (3A, 3B, 3C) for the third part of the Lego game. The Lego plans are again placed upside down on the table. "We are now at the third and last part of the Lego game. In front of you, we have placed three plans of Lego walls, and as before, you have 3 minutes to build as many rows of Lego that you can. However, this time you can decide which of the two payments schemes you prefer. Do you want to enter the competition with a chance to earn 2 points per Lego row, as you did in part 2, or do you want to stay out of the competition and earn 1 point per Lego row, as in part one? You have tried both. We will give you one minute to choose, and then you must tick the box on the Lego decision sheet. Do not look to what your classmates are writing; it has to be your own decision. Please, raise your hand if you have any questions. We will assist you now." The experimenters make sure that all participants indicate their decision on whether to enter the tournament or not on the Lego decision sheet. "Thank you for this. Now we are ready to begin. I will set the countdown clock. Are you ready? Ready, set, go build!"

"..3, 2, 1, and now the time is up! Stop building and do not touch the Lego bricks. We will now come and check your Lego walls." The experimenters use the plastic checker sheets, and write down the number of correctly built rows on each participant's Lego form. "Good job all of you! Now you have to separate all the bricks and put them back in the box. Again, none of them must stick together. Place the Test plan inside and close the box. We now ask you to answer two questions. Today you are # children participating in the game. How fast do you think you were at building with Lego compared with your classmates in the first part of the game? If you think you did best of all, you write one. If you think you did second best, you write two, and so on. If you think you did worst, you write #. Do you understand? Similarly, in the second part of the game, how fast do you think you were at building with Lego compared with your classmates? Do not look to what your classmates are writing; it has to be your own decision. Please, raise your hand when you are done or if you have any questions. We will assist you now." The experimenters take the Lego decision sheets and the boxes of Lego, and experimenter 2 begins to enter the data in the Excel sheet. In front of each participant, the decision sheet with the bomb game now lies facing up.

Task 2: The Bomb Risk Elicitation Task with pen and paper.

On the decision sheet of The Bomb Game there is a drawing of a winding road with exactly one hundred steps and they are numbered one through 100.

"This is the second game, and it is called The Bomb Game. In this game you have to imagine that you are in a minefield, and on the winding road that you see on the paper sheet, exactly one bomb is hidden behind one of the 100 numbers. For every step you take, you gain 1 point. You have to start at step one, then 2, 3 and so on. You indicate every step you take by writing a cross over that number, and you continue until you reach the step where you want to stop. You also have to write the number of steps that you finally decide you want to take in the box below on your left. (For the younger children: We will assist you with this.) You do not know the bomb's location. None of us does. You only know that it is equally likely to be behind any of the hundred steps on the winding road. After you have decided on the number of steps to take by writing a cross on each step, we will determine where the bomb is located by rolling two ten-sided dice (00 and 0=100). The dice look like this – see!"

If the number where the bomb is located is higher than the number of steps, you have taken, you have not stepped on the bomb and you earn 1 point for each of the steps you have taken. If the number where the bomb is located is lower than or equal to the number of steps you have decided to take, you have stepped on the bomb and lose all your points; it means that you get zero points. So the more steps you take, the more points you can make, but the risk that you will step on the bomb is also higher. How many steps will you take?

Let us try an example: Johan walks 25 steps and the bomb is hidden behind step number 21. Will he have stepped on the bomb? How many points will he get? What if Johan walks 75 steps and the bomb is hidden at step number 79, how many points will he get? Suppose Johan walks 48 steps and the bomb is also hidden at number 48, how many points will he get? Does the number of steps Johan decides to take have an influence on which step the bomb is located behind? You now have two minutes to make your decision. I will afterwards roll the dice and we will see where the bomb is located. You can begin now."

The participants have two minutes to make their decision, and they write it numerically below the winding road. The experimenters assist and check that this has been done for all the participants, before experimenter 1 rolls the two ten-sided dice to determine the location of the bomb. The decision sheets are thereafter collected by the experimenters, and experimenter 2 starts to enter the data in the Excel sheet. On the table in front of each participant, the decision sheet with the Friends Elicitation Task now lies facing up.

Task 3: Eliciting the network of friends.

The "A game with your friends" decision sheet has a drawing on it of a table with six chairs.

"The third game is a game with your friends. On this piece of paper a table and six chairs are drawn. Please write your own name above the chair at the head of the table. You also have to write the names of five friends in the class that you would like to have seated at the table next to you. No one will know what names you write, not your classmates or your teacher, and we will not tell anyone. You will receive 10 points for completing this task. If you have two people in this class who have the same first name, try also to write their last names. You can begin now, but make sure that none of your classmates see what you write."

Experimenter 1 takes the decision sheets, while experimenter number 2 finishes the calculation of the points. "We have calculated your total points, and we will now open our Experiment Shop. Hold on to the laminated numbers that you received when you entered the room. We will call you up one by one, and we will start with the person with number 1. We will let you know how many points you got in total, and you can then choose your prize."

Decision sheets and material:

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Lego

Number of rows in part 1: [ ]

Number of rows in part 2: [ ]

Do you choose to enter the competition: Yes [ ] No [ ]

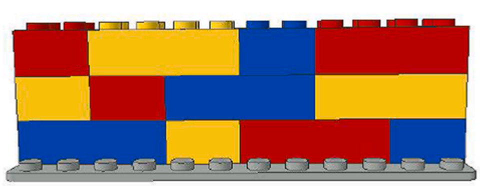
Number of rows in part 3: [ ]

How fast do you think you were in building with Lego compared to your classmates?

We are [ ] that are participating in the game.

In part 1 I'm number [ ] from the top.

In part 2 I'm number [ ] from the top.



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ID-nr.:____________

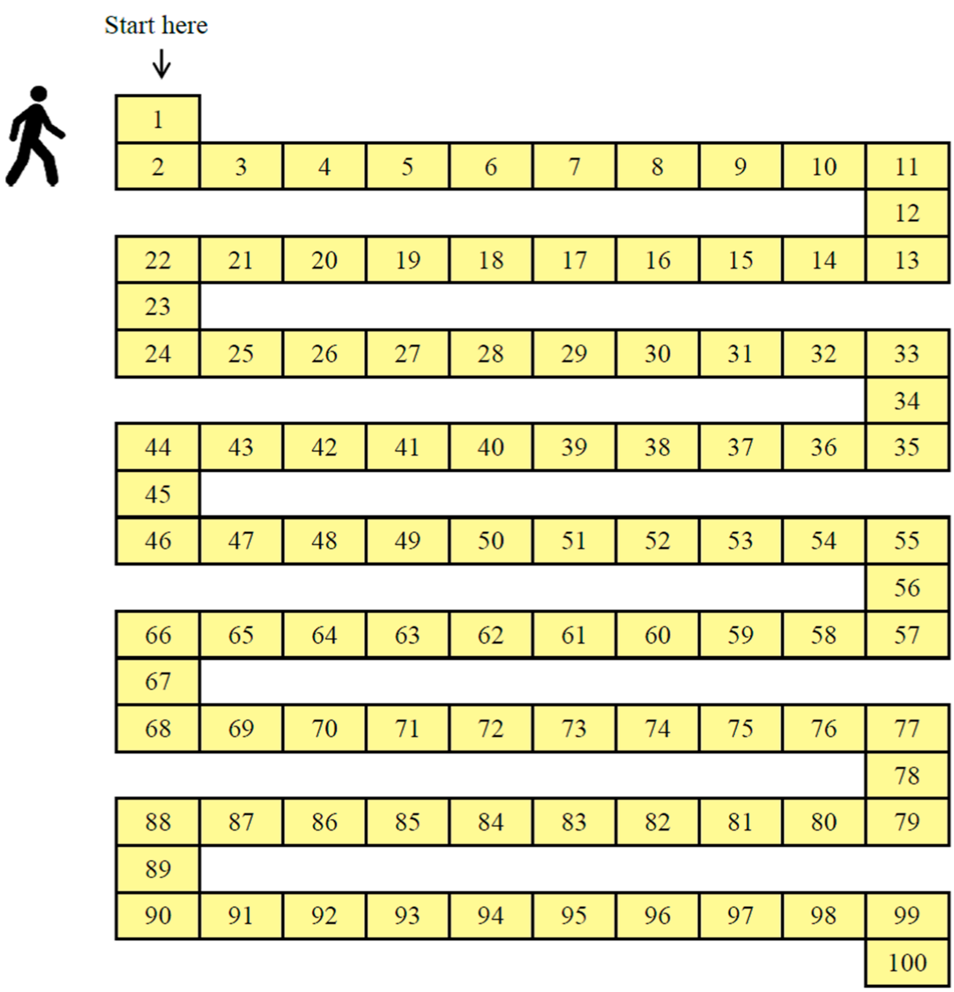
The bomb game

Imagine that you are in minefield and 1 bomb is hidden behind one of the 100 numbers below.

For every step you take you gain 1 point. If you step on the bomb you lose all your points.

How many steps will you take? Put a cross at every step you take.

The location of the bomb will afterwards be determined by a roll of two ten-sided dice.



Number of steps: Points:

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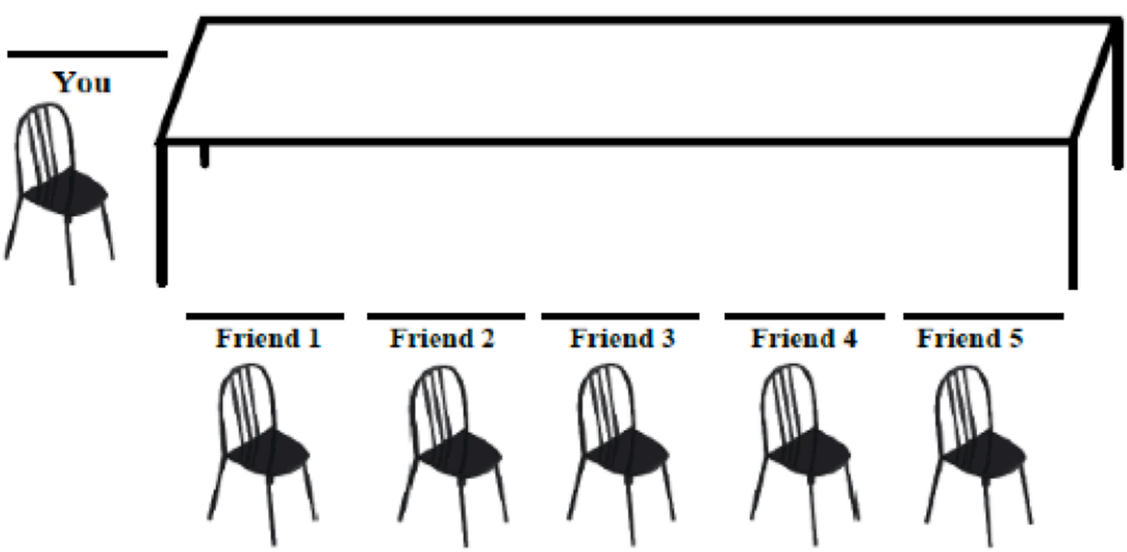
A game with your friends

Write your name above the chair at the head of the table. You have to write the names of up to five friends from your class above the remaining chairs at the long side of the table. Your best friend should be seated closest to you, your second-best friend second closest to you, and you go on like this.



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Other questions

1. Here is a picture of Gertrud, and here is a picture of Victor. They are both in the 5th Grade. Here they are building with Lego bricks.


How many rows of Lego do you think Gertrud managed to build in 3 minutes? ☐

How many rows of Lego do you think Victor managed to build in 3 minutes? ☐

2. How difficult was it to understand and make your decisions in the Lego game? (please tick a box)

Very easy									Very difficult
1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

3. How difficult was it to understand and make your decision in the Bomb game? (please tick a box)

Very easy									Very difficult
1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Note: The faces are hidden for privacy reasons. The test participants could see the children’s faces.

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