Replication of

Inequality and Visibility of Wealth in Experimental Social Networks

by Nishi, A. / Shirado, H. / Rand, D. G. / Christakis , N. A. (2015)
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In an experiment on Amazon Mechanical Turk (AMT), Nishi et al. (2015) let subjects play a networked public goods game under different conditions with respect to initial economic inequality ("none" (Gini= 0.0), "low" (Gini= 0.2) and "high" (Gini= 0.4)) and visibility of wealth information (invisible or visible). Subjects were placed in groups with an average size of 17.21 and arranged in a social network where they were initially connected to an average of 5.33 neighbors with whom they started playing with. The public goods game was played for 10 rounds and in each round subjects made a choice between paying 50 points to each one of his or her neighbors to increase their endowment with 100 points, or not to pay anything and, thus, not change their own or the other group member's points. For the high initial inequality condition the authors find that the visibility condition (in which all subjects know the wealth levels of their neighbors) leads to a higher Gini coefficient than the invisibility condition (in which the subjects only know their own wealth levels). The results imply that, in more unequal situations more wealth visibility leads to greater inequality.

Hypothesis to replicate and bet on:

In initially unequal situations, wealth visibility leads to greater inequality than when wealth is invisible (a comparison of the mean Gini coefficient between the visible and high initial inequality treatment and the invisible and high initial inequality treatment; OLS regression of the session/round Gini coefficient as the dependent variable and multiway clustering of standard errors at the session and round level; regression equation (5) in Table S2, $p = 0.0044$ of a t-test of the treatment dummy variable coefficient, $t(198) = 2.881$).

Power Analysis and Criteria for Replication: First Data Collection

The original sample size was 200 sessions by round observations of the Gini coefficient, and the standardized effect size measured as the correlation coefficient (r) was 0.201. To have 90% power to detect 75% of the original effect size a sample size of 462 sessions by round observations of the Gini coefficient is required. As one session consists of 10 rounds the number of sessions by round observations needs to be divisible by 10. And to also get the same number of sessions per treatment we will collect 480 sessions by round observations in the first data collection (24 sessions of 10

rounds in each of the two treatments). The criteria for replication is an effect in the same direction as the original study and a p-value < 0.05 (in a two-sided test).

Power Analysis and Criteria for Replication: Second Data Collection

In the first data collection we will use a sample of 480 sessions by round observations of the Gini coefficient. If the original result is not replicated in the first data collection (two-sided p-value < 0.05 in the original direction) a second data collection of 580 additional sessions by round observations of the Gini coefficient will be carried out so that the total sample size is 1060 sessions by round observations of the Gini coefficient (53 sessions of 10 rounds in each of the two treatments). If a second data collection is carried out, it will be tested if the original result replicates in the pooled sample of the first and second data collection.

To have 90% power to detect 50% of the original effect size a sample size of 1048 sessions by round observations of the Gini coefficient is required; but as this number needs to be divisible by 10 and to get the same number of session in each treatment 1060 sessions by round observations are needed; i.e. a sample size of 580 in the second data collection to have a sample size of 1060 sessions by round observations in total for the first and second data collection pooled. The criteria for replication is an effect in the same direction as the original and a p-value < 0.05 (in a two-sided test) in the pooled data.

Sample

The sample in the first data collection consists of 480 sessions by round observations recruited from AMT.

If the original result is not replicated in the first data collection (two-sided p-value < 0.05 in the original direction) a second data collection of 580 additional sessions by round observations from AMT will be carried out so that the total sample size is 1060 sessions by round observations.

Materials

The original experiment was programmed in a version of the program Breadboard, which is no longer supported. Thus we cannot use the same program as in the original experiment. We will therefore program the experiment in either the new version of Breadboard or on TurkServer or something similar based on the instructions provided in the Supplementary Information of the original study. We will also add a separate consent form to the replication.

Procedure

The original paper contains six experimental conditions/treatments: two levels of visibility and three levels of inequality. For the replication we only replicate two of these treatments: the visible treatment with high initial inequality (Gini= 0.4 for initial wealth) and the invisible treatment with high initial inequality. Subjects are recruited using AMT, with a new requester account, and told they will receive a $3.00 show-up fee for participating, for sessions that lasts approximately 45–60 minutes. If necessary to recruit a sufficient number of participants the show-up fee will be increased.

We follow the procedure of the original article (but only implement the two treatments mentioned above). The following summary of the experimental procedure is therefore based on section 1.1 (p. 2), section 1.3 (p. 9), section 1.4 (pp. 10–12) and section 1.5 (pp. 13–15) of the Supplementary Information.

In each session, the aim is to recruit 13–25 subjects to complete the entire session, which

includes two training rounds and ten actual rounds. Since it is anticipated that some subjects might drop out during the training, the initial recruitment will be 16-28 subjects (three more than the target range) at the beginning of each session. When the number of subjects reaches 28 or the recruitment time period (up to 15 minutes) expired, we move to the next steps: the explanation of the rules of the experiment (cooperation or defection, making a new connection or not, breaking an existing connection or not, etc), and then the two training rounds. If the number of subjects who show up don't reach at least 16, the attempted session (practice rounds and actual rounds) are canceled, but the show-up fee is paid to the subjects.

The two training rounds were performed with an initial wealth of 500 in both the "rich" and the "poor" group and a 50% probability of being allocated to the "rich" or the "poor" group. In the visible treatment the training rounds was performed with visibility of connected neighbors' wealth information and in the invisible treatment the training rounds was performed without visibility of connected neighbors' wealth information. The amount of wealth accumulated by the subjects at the end of the training rounds was not taken over into the actual rounds; wealth was reset, according to the experimental design, at the start of the actual experiment. When the number of subjects finishing the training rounds did not reach at least 13, the attempted session was canceled.

Then the participants are assigned to one location in an Erdos-Renyi random social network in a session (average size of 17.21 subjects in the original study), with possible connections between each pair of subjects realized with a probability of 0.3 (average 5.33 individuals connected as neighbors in the original experiment). Then, each subject is randomly assigned to one of the two initial wealth levels (poor or rich), with a 30% probability of being "rich" and a 70% probability of being "poor". The initial wealth level of "poor" individuals is 200 and the initial wealth level of "rich" individuals is 1150. This setting roughly generates an initial Gini Coefficient of 0.4. Subjects were not informed about the overall wealth distribution. In a random half of the experimental sessions subjects see connecting neighbors' wealth information (visible condition) and in the other half of the sessions a subject only sees his own wealth (invisible condition). Each session will be randomly assigned to one of the two treatments (with the same number of sessions in each treatment).

Each round consists of two steps: a cooperation step and a rewiring step and each subject play 10 rounds (the number of rounds was fixed, but this was not told to the subjects in order to prevent end-game effects; instead the game ended suddenly from the perspective of the players). In the cooperation step the subjects choose whether they want to cooperate with connecting neighbors by paying 50 units multiplied by the number of connecting neighbors or to defect against all of them and paying 0 units. Thus, for each connection, a subject earns either 100 units (defection towards cooperating neighbor), 50 units (both cooperation), 0 units (both defection), or ˘50 units (cooperation towards defecting neighbor). Prior to making their decision in each round, subjects are shown their connecting neighbors' last move (cooperate or defect), except in the first round (where no previous moves existed).

In the rewiring step 30% of all the possible pairs are randomly chosen if the subjects in those pairs are currently connected, one of the two subjects was picked at random to be the decision-maker, and that subject decided whether or not to dissolve the tie (tie-breaking was unilateral). If the chosen pair was not currently connected, both subjects were asked

if they wanted to form a tie; if both agreed, a tie was formed (tie-making was bilateral). The subjects are not informed of the rewiring rate of 0.3, which was held constant over the 10 rounds of all the sessions.

At the end of each session, the subjects were paid a $3.00 show-up fee and their earnings in the networked public goods game through AMT (each subject's final units, summer over all rounds, were converted into dollars at the exchange rate of $1.00 = 1,000 units).

The experiment will be in English as in the original study.

Analysis

The analysis will be performed exactly as in the original article. The main outcome variable – the Gini coefficient -– is measured at the session level in each round. A regression with the session/round Gini coefficient as the dependent variable and a dummy variable for the "visible" treatment as an independent variable is estimated (regression equation (5) in Table S2 in the Supplementary Information). The model is estimated with multiway clustering of standard errors at the session and round level.

In the original article the "visible" treatment dummy variable had a coefficient of 0.104 ($SE = 0.0361$) and p-value of 0.0040 based on a t-test of the regression coefficient. The same test will be used in the replication.

The Gini coefficient is defined as the "mean difference in wealth divided by twice the arithmetic mean" (following the scale invariance principle):

$$Gini = \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} |x_i - x_j|}{2n^2\mu}$$

Here, the wealth of each subject is given by x, the size of the population is given by n (i and j range from 1 to n in each $\sum$), and μ is the mean wealth of the population.

The results will first be estimated based on the first data collection. If the original result is replicated in the first data collection (a two-sided p-value < 0.05 in the same direction as the original study), the second data collection will not be carried out. If the original result is not replicated in the first data collection a second data collection will be carried out. The above statistical test will then be estimated for the pooled sample of the first and second data collection to test if the original result replicated (a two-sided p-value < 0.05 in the same direction as the original study).

The result above will be the main replication result. However, for completeness, we will also report the results in Figure 3 of the original paper and two logit regressions to measure cooperation behavior in Supplementary Table 7 (equations (5) and (8) of the Supplementary Table 7). Figure 3 shows average wealth, proportion of cooperation, network degree and transitivity and will be estimated over the 10 rounds for each game for the two conditions examined in this replication. Regression (5) of the supplementary Table 7 estimates cooperation rates in the second to tenth rounds for the invisible condition and Regression (8) in the same table estimates the same results for the visible condition.

Differences from Original Study

The replication procedure is the same as that of the original study, with some deviations. The replication will be performed at AMT between September 2016 and September 2017, whereas the data in the original study was carried out at AMT in 2013. As the version of Breadboard used is no longer supported, the program in the original experiment could not be used (and we will program the replication in either the new version of Breadboard or on TurkServer or something similar based on the instructions provided in

the Supplementary Information of the original study). We will also add a separate consent form to the replication. If necessary to recruit a sufficient number of participants the $3.00 show-up fee will be increased.

The original paper contains six different experimental conditions/treatments. For the replication only two treatments are included: the visible treatment with high initial inequality and the invisible treatment with high initial inequality.

Replication Results for the First Data Collection (90% power to detect 75% of the original effect size)

[To be added when replication experiments have been completed.]

Replication Results for the First and Second Data Collection Pooled (90% power to detect 50% of the original effect size)

[To be added when replication experiments have been completed.]

Unplanned Protocol Deviations

[To be added when replication experiments have been completed.]

Discussion

[To be added when replication experiments have been completed.]

References

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