Analy(s/z)ing the Neighbo(u)rhood: Economic Responses to Anglophone Regional Differences

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Intro

The side-by-side disciplines of game theory (GT) and behavioural economics have accumulated a vast amount of literature since their explosion in the 1950s. While the former uses "games" or simulated tasks to theoretically deconstruct simplified mathematical models that underly human behaviour, the latter uses predominantly psychological methods to analyse true human behaviour in such cases. Behavioural economics inherently contradicts the formalistic models of theoretical game theory challenging the field's most central assumption: we take for granted that conceptions of human rationality in mathematical models fail to do behaviour-making justice—behavioural economics started when academics attempted to formalise the imperfections in decision-making via bounded rationality (which allows for multiple values, informational costs, and limited utility functions).[1] More recent research has looked at the breakdown of other fundamental model conditions, like the independence of irrelevant alternatives, with the help of incorporating psychological concepts like attention filters.[2] Other breakdowns of this assumption have been proven with concepts like "choice overload," where individuals are more risk-taking when presented with a small subset of options relative to larger ones.[3] Interesting phenomena have been uncovered like status quo preferences: people prefer to make less decisions rather than more.[4] Clearly the field provides for a more flexible model of human decision-making than classical economics.

Some basic applications of behavioural economics in the game theory involve proving that theorists have long hypothesised: humans, even when playing against other players with no contact and remotely, tend to be more cooperative than economic hypotheses and game-playing against non-human opponents.[5] This cooperation is robust across games, like the ultimatum game which provides more room for deviation, and societies, often times even accentuated with interpretations of "hyper-fairness" that emerge from differing social scheme and conventions on morality.[6] From an evolutionary perspective, research suggests that a simple, iterated prisoner's dilemma game with a binary cooperate/defect decision is actually evolutionarily advantageous: in fact cooperation is the only outcome that can persist between

[1] Simon, Herbert A. 'Models of Man.' *Economica* 24, no. 96 (November 1957): 382. https://doi.org/10.2307/2550441.
[2] Masatlioglu, Yusufcan, Daisuke Nakajima, and Erkut Y. Ozbay. 'Revealed Attention'. *American Economic Review* 102, no. 5 (May 2012): 2183–2205. https://doi.org/10.1257/aer.102.5.2183.
Ok, Efe A., Pietro Ortoleva, and Gil Riella. 'Revealed (P)Reference Theory'. *American Economic Review* 105, no. 1 (January 2015): 299–321. https://doi.org/10.1257/aer.20111046.
[3] Iyengar, S. S., and M. R. Lepper. 'When Choice Is Demotivating: Can One Desire Too Much of a Good Thing?' *Journal of Personality and Social Psychology* 79, no. 6 (December 2000): 995–1006. https://doi.org/10.1037//0022-3514.79.6.995.
'Clearinghouse for Labor Evaluation and Research (CLEAR)'. Accessed 10 December 2019. https://clear.dol.gov/study/choice-proliferation-simplicity-seeking-and-asset-allocation-iyengar-kamenica-2010.
[4] Johnson, Eric J., and Daniel Goldstein. 'Medicine. Do Defaults Save Lives?' *Science (New York, N.Y.)* 302, no. 5649 (21 November 2003): 1338–39. https://doi.org/10.1126/science.1091721.
[5] Ellison, Glenn. 'Cooperation in the Prisoner's Dilemma with Anonymous Random Matching'. *The Review of Economic Studies* 61, no. 3 (1 July 1994): 567–88. https://doi.org/10.2307/2297904.
[6] Alvard, Michael S. *The Ultimatum Game, Fairness, and Cooperation among Big Game Hunters*. Oxford University Press, 2004. https://www.oxfordscholarship.com/view/10.1093/0199262055.001.0001/acprof-9780199262052-chapter-14.

players over time.[7] However, this equilibrium breaks down when payoffs shift between rounds, reflecting the increasing stakes in subsequent game with compounding payoffs and introducing irresistible incentives to deviate.[8]

This cooperate/defect decision is particularly important given the implications of trust. Dishonest behaviour decreases relational and empathetic capacity among participants and inhibits abilities to read others' emotions even when removed from the initial lie.[9] On the other hand, perspective-taking, where individuals are prompted to consider a situation from the perspective of another, can lead to non-cooperative outcomes anyways: MBA students were more likely to self-rate willingness to use unethical negotiation tactics when then took into account the other's perspective.[10]

This study in particular hopes to build on experimental game theory research referring to accents and identity in particular, in which there are two pieces of seminal literature. One looked at game-playing behaviour in Kampala, Uganda between differing ethnic groups: it found that co-ethnics were more likely to cooperate and come to consensus decisions in three different games. This provides some evidence for the idea of differing in-group and out-group, which will hopefully be extended in this study.[11] More specifically looking at accent, German researchers compared perceptions and economic decisions between standard German and the Bavarian variety. Here, they found that not only is there discrimination that affects relational performance on tasks, but there is also a substantial effect on economic decisions, with participants more likely to be competitive against players from outside their home region.[12]

However, one area where the research is scant refers to anglophone accent. This is despite its impact and known qualitative importance. Accents in many ways act as a marker, allowing individuals to quickly identify whether an individual belongs to an in-group that they are likewise a member in; anecdotally, one only has to leave the US to find Americans leaping at the sound of their compatriots.[13] Among native speakers, accent is used as a proxy for competence, explaining why English Second Language (ESL) speakers are consistently

[7] Stewart, Alexander J., and Joshua B. Plotkin. 'Extortion and Cooperation in the Prisoner's Dilemma'. *Proceedings of the National Academy of Sciences* 109, no. 26 (26 June 2012): 10134–35. https://doi.org/10.1073/pnas.1208087109.
[8] Stewart, Alexander J., and Joshua B. Plotkin. 'Collapse of Cooperation in Evolving Games'. *Proceedings of the National Academy of Sciences* 111, no. 49 (9 December 2014): 17558–63. https://doi.org/10.1073/pnas.1408618111.
[9] Lee, Julia J., Ashley E. Hardin, Bidhan Parmar, and Francesca Gino. 'The Interpersonal Costs of Dishonesty: How Dishonest Behavior Reduces Individuals' Ability to Read Others' Emotions.' *Journal of Experimental Psychology: General* 148, no. 9 (September 2019): 1557–74. https://doi.org/10.1037/xge0000639.
[10] Pierce, Jason R., Gavin J. Kilduff, Adam D. Galinsky, and Niro Sivanathan. 'From Glue to Gasoline: How Competition Turns Perspective Takers Unethical'. *Psychological Science* 24, no. 10 (October 2013): 1986–94. https://doi.org/10.1177/0956797613482144.
[11] Habyarimana, James, Macartan Humphreys, Daniel N. Posner, and Jeremy M. Weinstein. 'Why Does Ethnic Diversity Undermine Public Goods Provision?' *American Political Science Review* 101, no. 4 (November 2007): 709–25. https://doi.org/10.1017/S0003055407070499.
[12] Heblich, Stephan, Alfred Lameli, and Gerhard Riener. 'The Effect of Perceived Regional Accents on Individual Economic Behavior: A Lab Experiment on Linguistic Performance, Cognitive Ratings and Economic Decisions'. *PLOS ONE* 10, no. 2 (11 February 2015): e0113475. https://doi.org/10.1371/journal.pone.0113475.
[13] https://www.journals.uchicago.edu/doi/abs/10.1086/667654

rated lower in competitive debating than their native-speaking counterparts.[14] Studies have also been done on foreign perception of English accents: in Spain, the British accent is seen as more professional than the American one.[15] However, the American accent is consistently seen as more comprehensible in an academic setting for both American and British speakers, likely due to its status as the international accent of media and the US's vast cultural exports.[16] Among Australians and New Zealanders too, the American accent was rated as the most favourable, more so than their own native accents and exceeding the favourability of the Received Pronunciation, or BBC English.[17] Nonetheless, Britons themselves remain resistant: there is a complex pattern of attitudes within the country to the speech of their American peers but most remain unimpressed by speech across the Atlantic—the standard Network English or what Americans perceive as "no accent" was the only one to be at all rated favourably be groups. Those results, of course, depended heavily on class, though there was still some persistent aversion to the American accent.[18]

Thus, our hypothesis thus is threefold: (1) heterogenous groups will be less cooperative than homogenous pairs; (2) the homogenous groups will come to these decisions faster; and (3) the difference will be more visible among British participants than American ones.

Participants

Participants were mostly American and British students at the University of Cambridge; they included large amounts of individuals from Pembroke College's Fall Semester Programme in addition to visiting acquaintances from American institutions from Yale University, the University of Miami, and more. They were recruited via various university group chats—Students for Global Health, Economics Freshers, Linguistics Freshers, Pembroke College JCR Newsletter, Cambridge Hands On-Science (CHaOS), and Cambridge Debating to list a few—as well as via informal means and word of mouth. This obviously creates self-selection bias and potential questions of random participant selection: the experimental pool certainly is a subset of broader society in part defined by the researcher's own circles. Nonetheless, external validity problems and generalisability will be discussed later.

Prospective participants completed a given form[19] that screened for nationality and allowed for first-come-first-serve ID assignment (IDs in the 100s were used for Americans

[14] Buckley, Gemma. 'Language, cultural and religious discrimination in debating: an empirical study'. *Monash Debating Review*. Accessed 10 December 2019. https://monashdebaters.com/language-cultural-and-religious-discrimination-in-debating.

[15] Carrie, Erin. '"British is professional, American is urban": attitudes towards English reference accents in Spain'. *International Journal of Applied Linguistics* 27, no. 2 (2017): 427–47. https://doi.org/10.1111/ijal.12139.

[16] Gill, Mary M. 'Accent and Stereotypes: Their Effect on Perceptions of Teachers and Lecture Comprehension'. *Journal of Applied Communication Research* 22, no. 4 (1 November 1994): 348–61. https://doi.org/10.1080/00909889409365409.

[17] Bayard, Donn, Ann Weatherall, Cynthia Gallois, and Jeffery Pittam. 'Pax Americana? Accent Attitudinal Evaluations in New Zealand, Australia and America'. *Journal of Sociolinguistics* 5, no. 1 (2001): 22–49. https://doi.org/10.1111/1467-9481.00136.

[18] Hiraga, Yuko. 'British Attitudes towards Six Varieties of English in the USA and Britain'. *World Englishes* 24, no. 3 (2005): 289–308. https://doi.org/10.1111/j.0883-2919.2005.00411.x.

[19] https://forms.gle/85g8Zu7Fv61V1Tvv9

while those in the 300s were used for Britons); later participants could opt out of this step by providing emails and nationality to the researcher directly. With the assigned IDs, individuals were then prompted to fill out a Whenisgood[20] (an online, anonymous scheduling platform) to indicate their availability during the experimental period. Participants were then entirely paired based on availability given the substantial lack of overlap between participants; random selection was used in the rare cases where multiple participants were available for a slot. Experimenter intervention attempted to prevent participants who knew each other from being scheduled together to eliminate familiarity constraints; however, these are unavailable and can be controlled for via a post-task survey.

In all, 62 participants were recruited, of which 55 (25 Americans and 29 Britons) were eligible to participate: nationality was used as a proxy for accent. It's important to note that one participant noted dual US-Chilean nationality, while two others, after the conclusion of their trials, mentioned their status as Korean citizens but US permanent residents. However, because these were not documented, it is impossible to identify which participants they were, though we can be confident of the effects identified in the study regardless. All participants were anecdotally noted by the researcher to have accents characteristic of their home regions. Ultimately, 22 Americans and 18 Britons participated in the study in three different groups: 7 homogenous American and 5 homogenous British pairs, as well as 8 inter-group heterogenous pairs.

Materials

The three games to be used are all fairly ubiquitous in game theory practice. The first, a prisoner's dilemma (PD), measures cooperative action against an incentive to cheat. This incentive comes from the classical game theoretical strategy of Nash Equilibrium. Each player is given the option to push or pull: pushing gives the other player a payoff while pulling gives the player a payoff. If one player pushes and the other pulls, the pulling player collects the whole pot; alternatively, both pushing players bestow their pots to the other. In the following game, pushing gives $200 to the other player and pulling gives $100 oneself.

***P1**, P2 ($)*	Push	Pull
Push	**100**, 100	**0**, 150
Pull	**150**, 0	**50**, 50

In the matrix above, Player 1's payoffs are bolded and on the right; Player 2's gains are displayed in normal font after the comma. The Nash Equilibrium arises when both players have an incentive to pull regardless of the other players' behaviour: P1 stands to gain 100 from pulling in both of P2's potential moves—the converse is also true for P2.

The ultimatum game (UG) is simpler: an offering player splits a pot of money and the receiving player decides whether to accept their share of the split or reject, leaving both participants with a payoff of 0 if rejected. An actor could thus expect a $0 payoff if they reject, meaning that in the case of a $100 pot, an optimal proposer would suggest a 99/1 split, which a purely rational economic actor would not reject, as the alternative suggests a $0 payoff, which is lower than the $1 payoff offered by a rational offer.

[20] http://whenisgood.net/jn5f4se

Games well all played using the Moblab platform, which provided the researcher with an instructor licence. Chocolates—the participant reward—were Lindt chocolate packs provided by Pembroke College, supplemented by the researcher's purchases of another packet. All experimental sessions took place in Pembroke College hostel at the researcher's residence.

For the purpose of analysis, gameplaying results were converted into novel coefficients that facilitated comparison: these coefficients are deemed cooperative coefficients when looking at human-human rounds and competitive coefficients when analysing computer-human rounds and will henceforth be referred to as cc. The calculation differed between games, but the general principle remained. All coefficients were between 0 and 1, with 1 representing perfect cooperation and 0, perfect competition.

In the prisoner's dilemma, by-round comparisons could use the binary push/pull decision to draw statistical conclusions. However, synthesising behaviour over all 5 rounds lead to the following:

$$cc = \frac{\#\,Times\ Pushed}{\#\,Rounds}$$

In our case, there were always 5 rounds.

For the ultimatum game, the calculation was more complicated. Specifically, a coefficient was necessary to draw direct comparisons between strategies of different players. To this end, a binary indicator corresponding to a player's role was included in the analysis. For responding players faced with a binary decision, accepting the offer was deemed cooperative with cc = 1 while rejecting lead to cc = 0. For the numeric decision posed by the proposing player, the following conversion was used:

$$cc = \frac{1 - |n - n^*|}{n^*}$$

Where n is the offer and n^* was the cooperative equilibrium, or a fully equal split that divided the pot into two halves. In our case, n^* was always equal to 50 while n varied between 0 and 100. Full cooperation with a 50/50 split lead to a coefficient of 1, while deviation of a 100/0 split lead to a coefficient of 0.

Procedure

The prisoner's dilemma and ultimatum game were each played in 5 consecutive rounds with no change in the player. The games are played in said order, constantly, in order to reduce variability between pairs. Additionally, varying the game levels can introduce practice effects between participants: keeping a constant order allows for a between-groups comparison of competitive behaviour regardless of these effects. Ideally, changing between the games helps eliminate the confounding with the ordering effect, showing a difference in how behaviour develops. However, such comparisons require substantial sample sizes, which were unavailable for this study.

Ultimately, the most important thing to return to is cooperative effects: individuals obviously deviate from economic intuition for a wide splattering of reasons. Such effects become particularly stronger as players gain the ability to empathise more strongly, facilitated by practice effects, a built rapport between participants, and increasing data points that encourage future trust. The latter hinges on a key component of game theory in repeated games: the amorphous reputational benefits and costs that become embedded within multi-stage games. Simply, individual behaviour affects the propensity of collaboration and decisions of other players to trust or distrust, thus affecting the cooperative equilibrium. In such repetitive games, defection from the cooperative equilibrium is common in the final round, given the absence of reputational costs.[21]

Time pressures are intended to be a non-issue: each game should take around 5 minutes but can go up to 20 for the ambitious player. Ideally, each round of gameplay (all 3 games) should not exceed 30 minutes for an hour total per participant. These games will be played twice: first against a human opponent with only audial input and secondly against a computer/AI opponent. This is performed after the initial game because prior gameplay could bias individual behaviour and condition certain expectations about game strategy, minimising competitive equilibria. This would weaken the cooperative effects, while in the current design we can get individuals' first-reaction, untrained responses. However, the after-the-fact inclusion of computer gameplay will test individuals' inherent level of cooperation and the degree of match between cooperative strategies even if said strategies do transfer to the computer gameplay. Nonetheless, the second trials are a good way to verify results and show the standard cooperative deviation from game theoretical assumptions of a purely rational, economical actor. Additionally, such inclusions would help to distract participant attention away from the true subject of the study, focusing more on the gameplay and less on the accent effects.

Players are also given a questionnaire to fill out at the end of their participation asking their nationality, hometown, age, gender, subject of study, education level, familiarity with partner, length of time spent in the UK, and length of time spent in the US (if any).

Lastly, player earnings will be converted using a very minimal scale into real earnings via chocolate, giving an expected payoff of just a chocolate or two per participant for the average performer: all participants received a chocolate by default, 2 chocolates for earning above $1500, and 3 for more than $2000. Only one participant received more than one chocolate. By making some sort of financial incentive and introducing a competitive nature to the experiment, this can hopefully counterbalance and accentuate cooperative behaviour when it does occur by stimulating more heterogenous decisions among participants depending on their preferences and predispositions. As most game theoretical deviations are based on conceptualisations of "fairness," the presence of a consistent reward at the end creates a more parallel incentive structure.[22]

Data can be analysed both on an individual and pairwise basis: individual analyses would include indicator variables on the nationality of participants as well as the comparative backgrounds of participants (same/different). Ultimately, the effects are estimated to be subtle: individuals of all backgrounds are likely to deviate from the competitive equilibrium and cooperate strongly. This poses challenges for the analysis, as small effects are difficult to isolate with a small sample size: regression methods are likely to rate those effects as statistically insignificant, though the numbers remain to be seen.

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[21] Dixit, Avinash K., Susan Emily Skeath van Mulbregt, and David H. Reiley. *Games of Strategy*. 4. ed. New York, NY: Norton, 2015.

[22] Ibid.

Results

The data was cleaned in a variety of ways using R, leading to 3 ultimate datasets. In the prisoner's dilemma, the "cooperate" option coined "push" in the game was coded as 1, with deviation or "pull" coded as 0. The education variable was coded relative to a high school diploma (which would have been a 0), with each subsequent year of graduate or undergraduate schooling added to the variable. Time spent in the US and UK were interpreted by hand, complicated by the inclusion of "couple" or "a little under." "Couple" was interpreted as 2, and "a little under" was omitted, assuming a relative degree of closeness to the true value. Unclarified units were extrapolated with context when possible. Subjects of study were coded into a variety of indicators representing broader macro-categories as well as other groups of interest like economics and linguistics. Concerning the computer rounds, Moblab computer players commonly had multiple entries for computer players with different time and move values in separate entries; for the purpose of this study, I always selected the chronologically first one.[23] All variables were converted to binary variables when possible: for example, heterogeneity in pairs was a 1, while homogenous groups were 0; American nationals were a 1, and Britons were a 0. Subjects of study were converted into indicators for particular fields and macro categories as well. Prisoner's dilemma and ultimatum game outcomes were analysed separately given their lack of direct comparability.

The three ensuing datasets were by-participant, by-round, and a reduction of the by-round to only include players who were the proposing player in both plays of the ultimatum game, respectively.

The variables of interest in our case were measures of cooperation, raw player decision data, and reaction time information. Starting with the first dataset, we can examine their distributions. The by-participant data only had information on the cc rather than the raw strategy.

[23] In hindsight, as such computer player data was omitted, the latter option should have been selected instead of the former; the round would likely not conclude until a computer player made its final decision and thus the second value may be more emblematic of the actual round length and lead to an overestimate of decision times in the sample here.

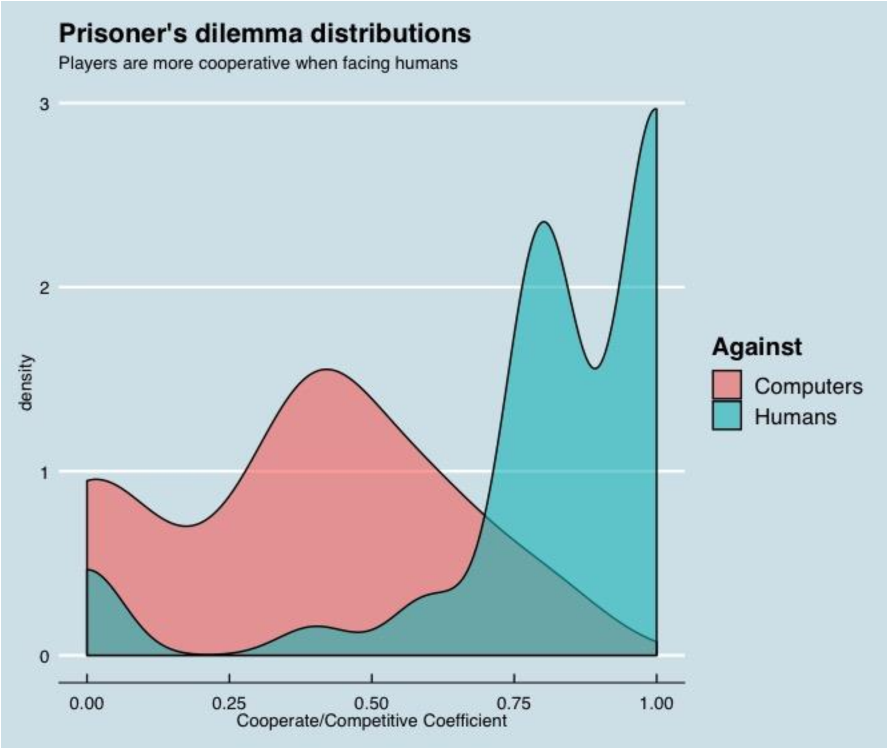

Figure 1: Distribution of prisoner's dilemma cc by round (dataset 1)

The results show that the distribution of behaviour differs substantially between iterations: against a human player, individuals were very likely to collaborate. Defective behaviour occurred in just one round if any, backing up the economic intuition to deviate in the final round when there is less cost of retribution. A two-sided t-test found a significant difference at the 5% level between these means, as well as the mean of their differences separated by nationality of participants: Americans are more cooperative than Britons, with a smaller difference between their intertrial behaviour.

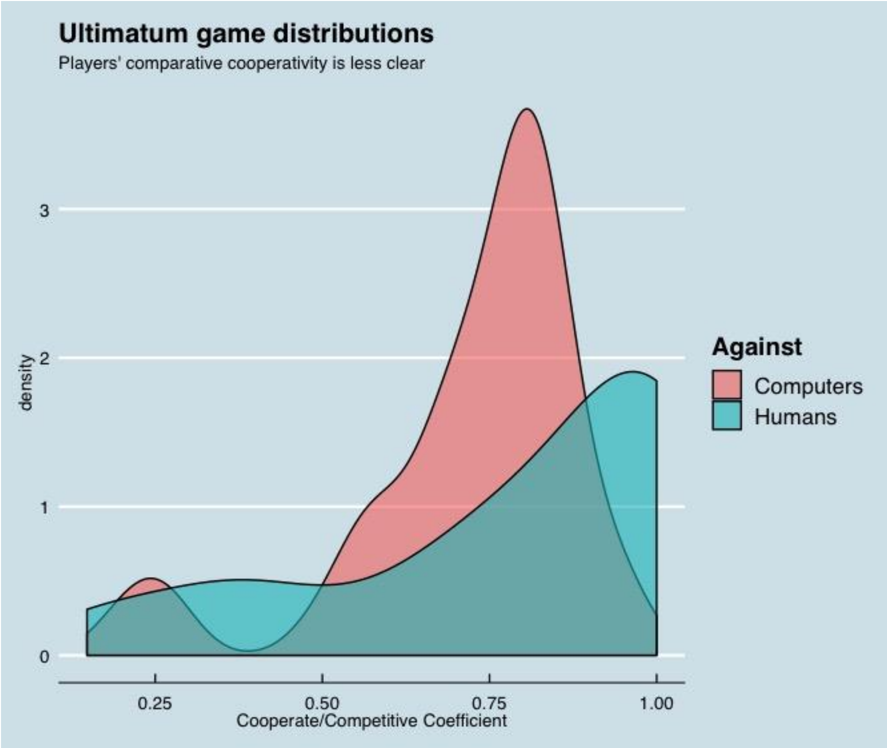

Figure 2: Distribution of ultimatum game cc by round (dataset 1)

The ultimatum game provides a similar, albeit weaker, conclusion. It appears that humans are more perfectly cooperative against non-computer opponents, the distribution of which appears substantially less uniform. No statistical significance can be concluded from these differences, though at the 10% level there appears to be evidence that the British are more cooperative than their American counterparts. British-American groups are henceforth referred to as "experimental" with exogenous pairs being the treated condition, while homogenous American or solely British pairs are considered the "control" case.

Variable	**Mean**	**Std Dev**	**Min**	**Max**
ID	307 216	7 172	263 038	308 956
Nationality	0.550	0.504	0	1
Age	19.80	1.224	18	23
Gender	0.575	0.501	0	1
Education	2.450	1.154	1	5
Time in UK (yrs)	8.366	9.237	0.00822	21
Time in US (yrs)	10.15	9.495	0	23
Partner familiarity	1.825	1.035	1	4
GT familiarity	2.600	1.008	1	4
Target group indicator	0.400	0.496	0	1
PD earnings round 1 ($)	453.8	86.52	150	550
PD earnings round 2 ($)	411.2	104.7	200	650
Economics indicator	0.150	0.362	0	1
Linguistics indicator	0.0500	0.221	0	1

STEM indicator	0.300	0.464	0	1
Social science indicator	0.475	0.506	0	1
Humanities indicator	0.275	0.452	0	1
Group #	10.50	5.840	1	20
PD cc round 1	0.815	0.273	0	1
PD cc round 2	0.365	0.260	0	0.800
UG role round 1	0.500	0.506	0	1
UG cc round 1	0.778	0.271	0.148	1
UG cc round 2	0.720	0.173	0.200	0.948
UG earnings round 1 ($)	195	75.42	10	278
UG earnings round 2 ($)	167.3	67.71	0	290

Table 1: Summary Statistics for Dataset 1 (N = 40)

In the first dataset, which has a fairly low power, we see fairly expected results. More than half of participants were American, aged 19, almost 20, on average but all falling between the ages of 18 and 23. Slightly more men than women were recruited, and all participants attained some college education (with the exception of one first-year graduate student, all participants were undergraduates). The average American spent a quarter of a year in the UK, while the average Briton spent only 14% of a year, or a little over 1.5 months in the US. Most participants were generally unfamiliar with their partner and rated their knowledge of game theory as passing. 12.5% of students were economists and 5% were linguists: there were good showings for all disciplines though social sciences were slightly overrepresented. 37.5% were in heterogeneous groups, with the rest playing against those of the same nationality. Participants earned slightly more in the first round, about $50 in the PD and $30 in the UG. Both in the PD and UG, participants were fairly cooperative in round 1 while that communal spirit deteriorated fast in round 2, especially for the PD—where not a single participant was perfectly cooperative with the computer player.

Basic OLS regressions were utilised for all regression methods with robust standard errors using the following equation.

$$y_i = \beta_0 + \beta_i \cdot \mathrm{x}_i + u_i$$

y_i represents any of the 14 different dependent variables, including the move strategies, reaction times, cooperative coefficients, and the differences between rounds of all of the preceding. x_i is any of the dependent variables in the situation, including indicators about target groups, demographic controls, and by-game variables like earnings.

The interpretation of results should follow basic statistic convention. In a bivariate regression with the bare minimum controls, "(UK) experimental" refers to an indicator variable for heterogeneity: its coefficient is the difference in dependent variable for a heterogenous pair relative to a homogenous one. However, when other target variables of "US control" and "US experimental" are introduced, the three represent the relative change in target variable of each category relative to the omitted indicator, British controls (homogenous pairs).

Now, we can comfortably move on to statistical inference. Games were analysed separately, with two different regressions for each—player cc was analysed in the first round in isolation, including their round 2 cc as a control in all regressions. Another strategy yielded the difference in cc between rounds.

Regressor	**(1)**	**(2)**	**(3)**	**(4)**
(UK) experimental	0.122* (0.0656)	0.0754 (0.0866)	0.221** (0.0824)	0.216** (0.0907)
US control		0.109 (0.133)	0.151 (0.362)	0.175 (0.536)
US experimental		0.0998 (0.138)	0.0659 (0.174)	0.0612 (0.205)
PD cc round 2	0.332* (0.195)	0.437** (0.211)	0.394** (0.178)	0.382* (0.189)
Age			-0.197** (0.0782)	-0.198** (0.0855)
Gender			0.129 (0.102)	0.119 (0.110)
Education			0.256** (0.103)	0.258** (0.110)
Time in UK			-0.0189 (0.0121)	-0.0214 (0.0178)
Time in US			-0.0234 (0.0166)	-0.0259 (0.0197)
Participant familiarity			0.0523 (0.0666)	0.0631 (0.0691)
GT familiarity			-0.0197 (0.0440)	-0.0312 (0.0483)
Economics			-0.0892 (0.110)	-0.0778 (0.128)
Linguistics			0.347* (0.196)	0.372 (0.227)
STEM				0.125 (0.115)
Social science				0.0335 (0.142)
Humanities			-0.122 (0.120)	-0.0854 (0.118)
Diff in PD earnings			0.000996*** (0.000350)	0.00106*** (0.000327)
Constant	0.646*** (0.123)	0.556*** (0.159)	4.028*** (1.305)	4.032** (1.524)
Summary Statistics				
R^2	0.164	0.239	0.630	0.649

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Table 2: Data 1 Regression Results w/ Dependent Variable *PD cc round 1*

Here we see an unintuitive and surprising result: indivi duals are actually more cooperative with those of the out-group than their in-group (relative to British controls). This relationship is particularly robust with the inclusion of controls: a Briton paired with an

American is 22.7 pp more collaborative than his homogeneously paired compatriot. Though not statistically significant, Americans appear to be more collaborative than the British and less so when faced with a heterogenous partner. Unsurprisingly, those more collaborative in the second round were equally likely to push in the first one, controlling for individual propensity to cooperate. Those who were younger and more educated were more likely to cooperate; familiarity with partners lead to more collaboration while self-reported game theory knowledge was inversely linked with performance; here, they may be some influence of the Dunning-Krueger effect, where particularly self-confident individuals both highly rate their game theory abilities and are more likely to prioritise the importance of earnings. Either way, given the cutthroat nature of strategies taught in classical game theory, this is unsurprising. Economists were less cooperative, as were their humanist peers, while linguists and engineers were more likely to work together. A weak, but significant effect was found with a difference in earnings: the more earnings in round 1 outnumbered those in round 2, the more cooperative they were likely to be: given an expected value of around $450 against a computer compared to $500 from full cooperation, this is entirely expected. Regression (3) can be expected to be the most accurate representation of the true relationships via the elimination of superfluous controls. These results present an interesting and unanticipated conclusion, which can be furthered by examining additional data.

Regressor	(1)	(2)	(3)	(4)	(5)
(UK) experimental	0.0833 (0.0936)	0.00500 (0.0770)	0.0380 (0.0684)	0.0645 (0.0792)	0.0767 (0.121)
US control		0.166 (0.128)	0.183 (0.116)	0.112 (0.194)	-0.0573 (0.659)
US experimental		0.184 (0.156)	0.202 (0.156)	0.257 (0.172)	0.233 (0.229)
Age				-0.337*** (0.0793)	-0.326*** (0.0975)
Gender				0.148 (0.130)	0.150 (0.160)
Education				0.393*** (0.116)	0.394** (0.143)
Time in UK					-0.0259 (0.0251)
Time in US					-0.0164 (0.0219)
Participant familiarity				0.0410 (0.0718)	0.0572 (0.0853)
GT familiarity				-0.0202 (0.0476)	-0.0118 (0.0606)
Economics					0.00580 (0.199)
Linguistics				0.389** (0.154)	0.427** (0.192)
STEM					0.0620 (0.161)
Social science				-0.115	-0.119

				(0.0883)	(0.179)
Humanities				-0.188 (0.111)	-0.176 (0.139)
Diff in PD earnings			0.000614* (0.000331)	0.000671** (0.000319)	0.000698** (0.000321)
Constant	0.417*** (0.0694)	0.320*** (0.0680)	0.268*** (0.0576)	5.973*** (1.296)	6.142*** (1.586)
Summary Statistics					
R^2	0.018	0.196	0.260	0.544	0.573

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Table 3: Data 1 Regression Results w/ Dependent Variable *Diff in PD cc*

Unfortunately, this additional PD data proves weaker evidence than the prior analysis: gaps in R^2 signify the relative weakness of the relationship. We see similar trends in this data, which examines differences in participant PD cc between rounds. Coefficients occasionally flip signs, given their closeness to 0, and variables like time in the UK and US are found to be unhelpful to the general results. Here, too, we see a positive relationship between heterogeneity among Britons, though in this regression the effect appears similarly directed for Americans as well; weakly, Americans remain more cooperative than their anglophone peers. Age, education, linguistics, and difference in earnings remain correlated signalling the particular prevalence of those effects in the data.

Regressor	(1)	(2)	(3)	(4)	(5)
(UK) experimental	0.0271 (0.0882)	-0.0558 (0.0969)	-0.0223 (0.0820)	0.0507 (0.0927)	0.0498 (0.101)
US control		-0.202* (0.104)	-0.103 (0.0781)	-0.678 (0.597)	-0.674 (0.593)
US experimental		0.129 (0.181)	-0.0679 (0.164)	-0.116 (0.140)	-0.117 (0.187)
Role (round 1)		0.00857 (0.0964)	0.121 (0.0844)	0.130 (0.0973)	0.129 (0.108)
UG cc round 2	0.168 (0.268)	0.0314 (0.290)	0.668*** (0.232)	0.394 (0.237)	0.395 (0.259)
Age				-0.0545 (0.0833)	-0.0538 (0.0903)
Gender				0.0481 (0.0747)	0.0473 (0.0896)
Education				0.0758 (0.106)	0.0745 (0.127)
Time in UK				-0.00323 (0.0186)	-0.00302 (0.0199)
Time in US				0.0221 (0.0206)	0.0223 (0.0213)
Participant familiarity					-0.00131 (0.0564)
GT familiarity					-0.000350 (0.0497)

Economics				-0.180 (0.115)	-0.180 (0.121)
Linguistics					-0.00266 (0.182)
STEM				0.112 (0.0723)	0.112 (0.0774)
Social science				0.274*** (0.0927)	0.275*** (0.0916)
Humanities				0.298*** (0.0967)	0.299** (0.113)
Diff in UG earnings			0.00228*** (0.000405)	0.00172*** (0.000510)	0.00172*** (0.000553)
Constant	0.646*** (0.210)	0.859*** (0.219)	0.253 (0.187)	1.208 (1.376)	1.195 (1.418)
Summary Statistics					
R^2	0.014	0.096	0.450	0.674	0.674

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4: Data 1 Regression Results w/ Dependent Variable *UG cc round 1*

Looking at the ultimatum game provides a vastly different set of results. Looking at just the cc from the first round, we see American homogeneous pairs to be the least collaborative. The remaining effects remain small and statistically insignificant but are still worth mentioning. In this case, we find a significant, opposite effect for humanities students who show a greater change in cooperative behaviour; economists, expectedly, retain their seat at the uncompromising table. Here it appears that Americans are the less cooperative of the two groups, with homogenous pairs similarly more selfish than their heterogenous counterparts.

Regressor	(1)	(2)	(3)	(4)	(5)
(UK) experimental	0.0380 (0.0954)	-0.0747 (0.117)	-0.0222 (0.0820)	0.0366 (0.0859)	0.0252 (0.0939)
US control		-0.111 (0.132)	-0.0662 (0.0766)	-0.603 (0.458)	-0.558 (0.561)
US experimental		0.207 (0.198)	-0.0767 (0.170)	-0.0825 (0.146)	-0.0619 (0.189)
Role (round 1)		-0.0735 (0.106)	0.117 (0.0827)	0.114 (0.0953)	0.105 (0.108)
Age				-0.101 (0.0796)	-0.0952 (0.0870)
Gender				0.0862 (0.0691)	0.0913 (0.0962)
Education				0.114 (0.103)	0.104 (0.124)
Time in UK					0.00350 (0.0159)
Time in US				0.0261 (0.0207)	0.0264 (0.0217)

Participant familiarity					0.00446 (0.0594)
GT familiarity					-0.00677 (0.0510)
Economics				-0.166 (0.116)	-0.162 (0.129)
Linguistics					-0.0765 (0.173)
STEM				0.0758 (0.0769)	0.0734 (0.0852)
Social science				0.179** (0.0854)	0.180* (0.0950)
Humanities				0.249** (0.0972)	0.256** (0.119)
Diff in UG earnings			0.00260*** (0.000391)	0.00229*** (0.000520)	0.00230*** (0.000579)
Constant	0.0430 (0.0685)	0.145 (0.101)	-0.0117 (0.0653)	1.528 (1.326)	1.390 (1.446)
Summary Statistics					
R^2	0.004	0.045	0.547	0.694	0.696

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5: Data 1 Regression Results w/ Dependent Variable *Diff in UG cc*

A regression of the differences finds statistically more meaningful results. Economists, humanities students, and the difference in earnings all remain significant in the same direction; the variable of interest, however, appears to have a more complicated relationship. In some cases, the value hovers around 0 for the British experimental participants. Here, again, Americans are less cooperative en masse, with homogenous pairs less cooperative than their heterogeneous counterparts. This regression does, however, have more power via the R^2 values, signalling that we can be more confident in the joint findings from the ultimatum game.

Now that we've examined the by-participant data, there may be more informative results from the by-period breakdown. As each game was repeated over 5 period in each round, there is substantially richer information supplemented by selected demographic controls. The target variables here also need not be meddled with, with PD and UG behaviour directly observable; due to the limitations of UG, the cc will still need to be used on a by-round basis until the third dataset. Additionally, the inclusion of reaction time metrics give us a much more comparable information set.

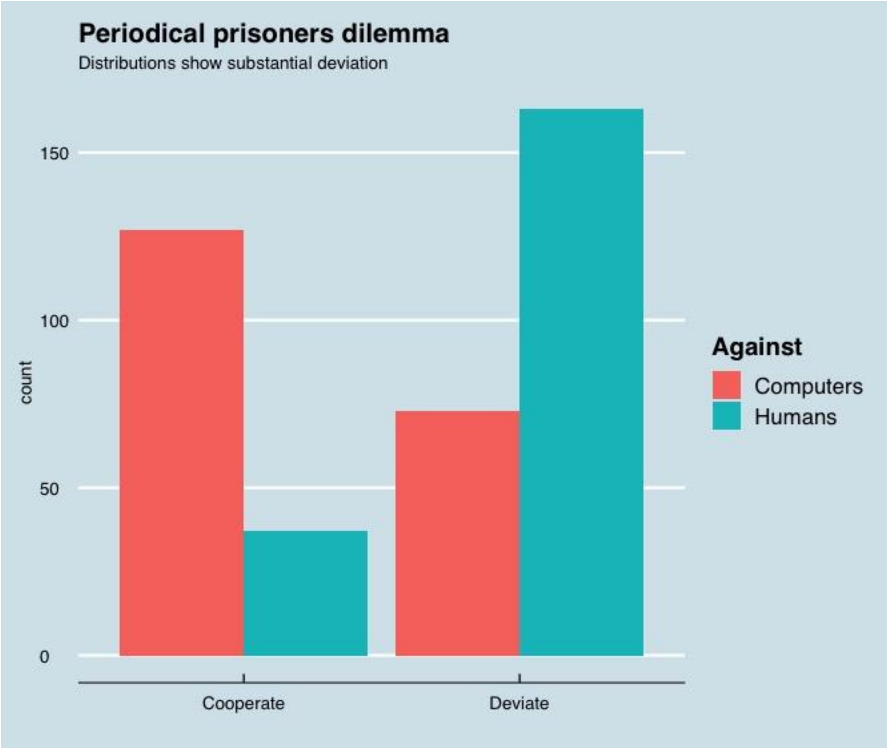

Figure 3: Distribution of prisoner’s dilemma moves by round (dataset 2)

Here we see the PD outcome: there is substantially more cooperation between human players, as we’ve expected from the period data. Two-sided t-tests confirm the difference is significant at the 5% level, as is the difference between nationalities with Americans displaying a larger difference in gameplaying behaviour between rounds signalling their especial embrace of human-human cooperation. Looking just at round 1 behaviour, similar t-tests found a difference between behaviour based on group composition, with heterogeneous pairs more cooperative than their homogenous counterparts.

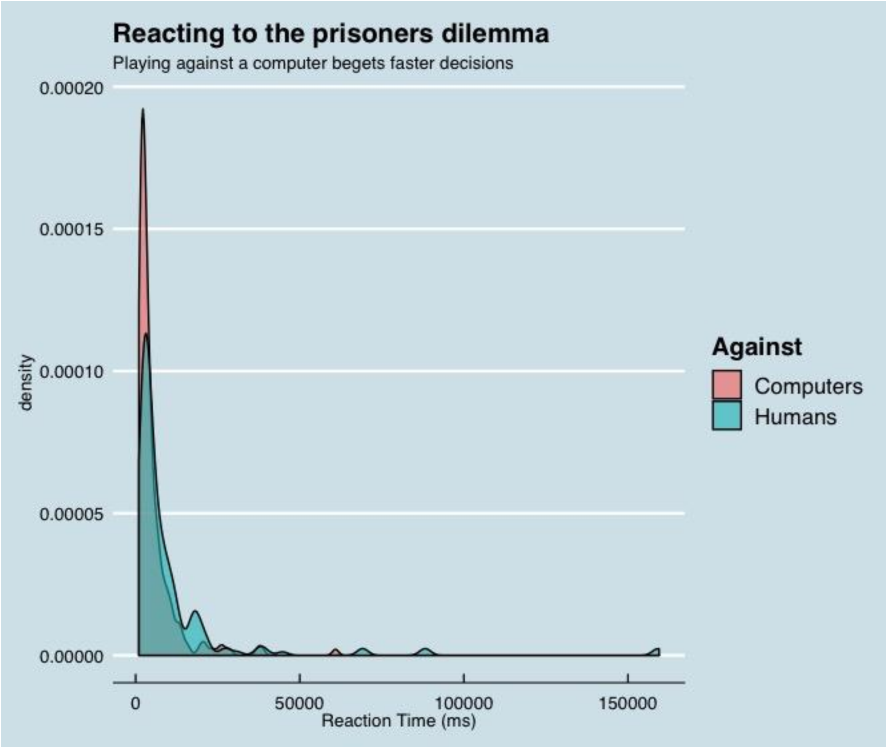

Figure 4: Distribution of prisoner's dilemma reaction time by round (dataset 2)

The trends here signal a much faster reaction time against computers: players tend to think and reflect more deeply on their moves when faced with a dynamic game-playing environment (though this could in part be attributed to practice effects). The nature of the distribution—single-peaked and highly right-skewed with small bumps extending all the way to 2.5 minutes signals how there is substantially more lag and deviation on the reaction times, potentially relating to implicit cooperativity and innate behaviours.

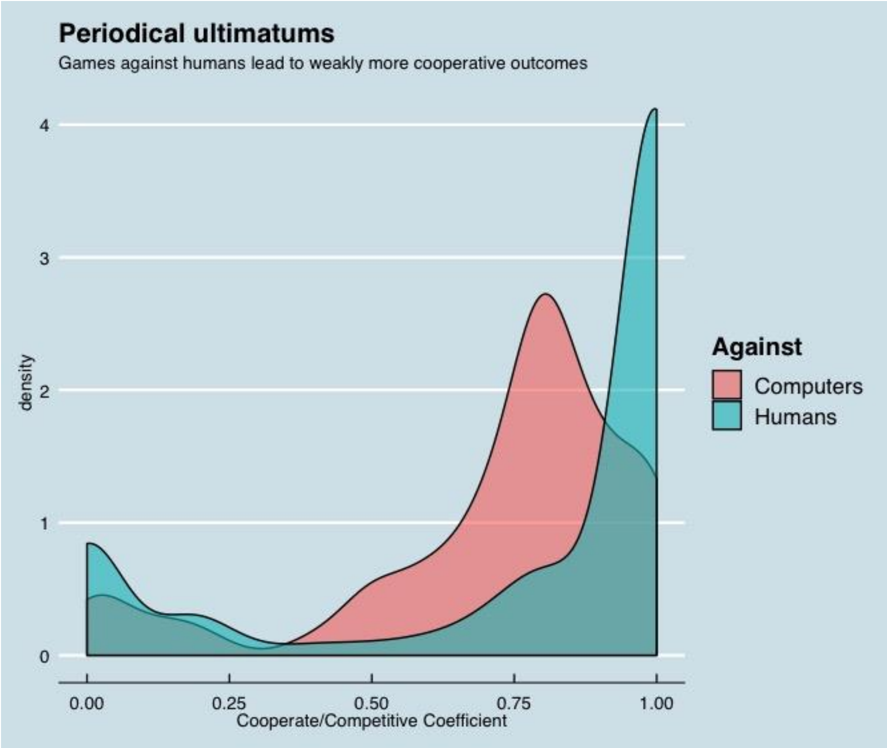

Figure 5: Distribution of ultimatum game cc by round (dataset 2)

On the ultimatum game, we see similar results to the previous by-participant distribution; it is a slightly more nuanced presentation of the same data after all. This time around, however, a t-test finds the difference in means to be not equal to 0. Interestingly, Britons are substantially more cooperative when excluding all responding players from the comparison of differences at the 5% level. The round 1 results show that the mean of the cc is not 0, clearly visible from the distribution but breaking with classical game theory intuition. In that round, Britons were significantly more cooperative than Americans at the 1% level, and even more so when excluding responding players; heterogenous pairs were more cooperative as well at the 5% level.

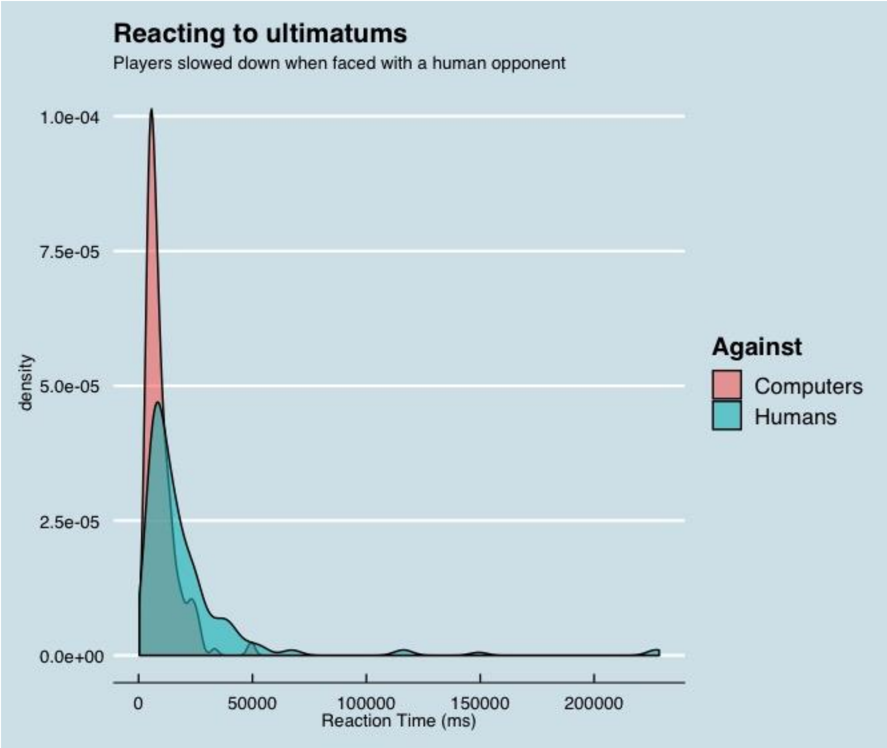

Figure 6: Distribution of ultimatum game reaction time by round (dataset 2)

Time differences here appear relatively similar to the PD time data: the distribution here is more spread out likely reflecting the computational difficulty of making a multinomial decision—the maximum is almost 4 minutes' worth of decision-time with the peak more distributed as well. However, we see an even more substantial difference in the density of decision-making, exemplifying how people generally take longer against human players.

Variable	Mean	Std Dev	Min	Max
ID	307,216	7,099	263,038	308,956
Nationality	0.550	0.499	0	1
Age	19.80	1.211	18	23
Gender	0.575	0.496	0	1
Education	2.450	1.142	1	5
Time in UK	8.366	9.144	0.00822	21
Time in US	10.15	9.399	0	23
Participant familiarity	1.825	1.025	1	4
GT familiarity	2.600	0.997	1	4
Target group indicator	0.400	0.491	0	1
Group #	10.50	5.781	1	20
Period	3	1.418	1	5
PD move (round 1)	0.815	0.389	0	1
PD move (round 2)	0.365	0.483	0	1
PD reaction time (round 1)	10,333	19,503	984	159,500
PD reaction time (round 2)	5,450	7,019	1,000	60,891
UG player role (round 2)	0	0	0	0
UG move (round 2)	37.05	14.15	0	92
UG payoff (round 2)	33.47	27.36	0	60

UG reaction time (round 2)	9,676	7,114	341	49,727
UG player role (round 1)	0.500	0.501	0	1
UG payoff (round 1)	39	24.60	0	100
UG reaction time (round 1)	20,300	27,749	3,263	228,555
UG cc (round 2)	0.720	0.262	0	1
UG cc (round 1)	0.778	0.363	0	1

Table 6: Summary Statistics for Dataset 2 (N = 200)

The first 11 variables were transferred from the by-participant data; their means are identical as are max/min values, but SEs are smaller given the increased sample size (n went from 40 to 200). Concerning the novel variables, players were divided 50/50 to roles in the first UG round and, interestingly, all participants proposed in the second round. The round reaction times for both games line up with their aforementioned distributions: the means appear particularly driven by values at the extreme positive. For the prisoner's dilemma moves and UG cc we see the same trends deconstructed prior. Payoffs appeared higher in the first round of the UG, while no player earned more than $60 in the subsequent trials; there was a higher deviation of outcomes in round 2, as players sought to keep as much as $92. The $4 difference between the move and payoff in round 2 show the difference between expectations and realised values for players. Round 1 moves, due to the complicated nature of offering and proposing players, will be analysed separately using a reduced dataset. All following regressions were conducted with robust, non-clustered SE.[24]

Regressor	(1)	(2)	(3)	(4)
(UK) experimental	0.129** (0.0499)	0.131*** (0.0491)	0.104 (0.0767)	0.114 (0.0808)
US control			0.0864 (0.0774)	0.0764 (0.254)
US experimental			0.0654 (0.101)	0.111 (0.113)
PD move (round 2)	0.219*** (0.0453)	0.182*** (0.0478)	0.207*** (0.0524)	0.221*** (0.0537)
Age				-0.133** (0.0598)
Gender				0.0597 (0.0565)
Education				0.233*** (0.0690)
Time in UK				-0.0103 (0.0122)
Time in US				-0.0234*** (0.00839)
Participant familiarity				0.0620 (0.0393)

[24] Conceptually, it makes more sense to run the regressions with SE clustered by ID, as non-clustered errors would artificially deflate the significance of coefficients by not taking into account the correlation between rounds of player behaviour; however, insufficient time meant that there was when this was identified there was too little time to re-code, re-run, and re-analyse the data.

GT familiarity				-0.00660 (0.0301)
Period 2 indicator		0.0728 (0.0648)	0.0759 (0.0652)	0.0776 (0.0650)
Period 3 indicator		-0.0340 (0.0832)	-0.0284 (0.0841)	-0.0253 (0.0827)
Period 4 indicator		0.00921 (0.0774)	0.0174 (0.0782)	0.0218 (0.0773)
Period 5 indicator		-0.134 (0.0956)	-0.121 (0.0934)	-0.115 (0.0932)
Constant	0.684*** (0.0473)	0.713*** (0.0723)	0.648*** (0.0888)	2.899*** (1.002)
Summary Statistics				
R^2	0.105	0.134	0.155	0.208

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7: Data 2 Regression Results w/ Dependent Variable *PD move (round 1)*

Looking at just the binary push/pull decision in the PD, we see again that heterogenous pairs are significantly more cooperative than their homogenous counterparts. Americans are more cooperative than their British counterparts, both in experimental and control groups. Probit and logit models could have been used in this case, however the difficulty in interpreting coefficients cautioned us from their use. The round 2 and period controls proved both helpful and significant: periods 2 and 4 were the most cooperative, while the first, last, and middle period understandably faced un-cooperative pressures to deviate. We see similar relationships in other cases as well: familiarity with game theory lead to decreased cooperation; participant familiarity on the other hand made participants more cooperative; increased time in both the US and UK lead to less cooperation, potentially by diminishing the heterogeneous novelty. Age, education, and gender effects roughly match past results.

Regressor	(1)	(2)	(3)	(4)
(UK) experimental	0.0833 (0.0761)	0.0833 (0.0755)	0.00500 (0.103)	-0.00248 (0.107)
US control			0.166* (0.0950)	0.0319 (0.505)
US experimental			0.184 (0.146)	0.246 (0.166)
Age				-0.282*** (0.0794)
Gender				0.146 (0.0924)
Education				0.374*** (0.0983)
Time in UK				-0.00793 (0.0226)
Time in US				-0.0136

				(0.0158)
Participant familiarity				0.0404 (0.0639)
GT familiarity				-0.0172 (0.0408)
Period 2 indicator		0.175 (0.113)	0.175 (0.111)	0.175 (0.111)
Period 3 indicator		0.150 (0.123)	0.150 (0.121)	0.150 (0.118)
Period 4 indicator		0.275** (0.113)	0.275** (0.112)	0.275** (0.108)
Period 5 indicator		0.275** (0.113)	0.275** (0.111)	0.275** (0.111)
Constant	0.417*** (0.0482)	0.242*** (0.0869)	0.145 (0.0923)	4.962*** (1.349)
Summary Statistics				
R^2	0.006	0.043	0.102	0.169

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: Data 2 Regression Results w/ Dependent Variable *Diff in PD move*

Looking at differences, we find similar effects across the board, but with less significance. We see near-zero effects between British participants, with slightly less cooperation among the experimental group. Americans were more cooperative than Britons, especially the experimental group. We see the expected relationships with age and education, as well as significantly larger differences in the latter periods: this could be due to game-playing strategies. Players could often peruse differences in initial periods and magnify their risk-taking behaviour near the end. Ultimately, this result is unintuitive, but statistically significant, presenting us with progressively diverging gameplay strategies between rounds. Ultimately, the smaller effects in less-interacted regressions could be in part due to the closeness of the coefficients to 0, bumping up against previous issues as well.

Regressor	(1)	(2)	(3)	(4)	(5)	(6)
Diff PD move	-3,355 (2,691)	-4,014* (2,159)	-1,485 (2,254)	-1,481 (2,220)	-2,249 (2,355)	-2,158 (2,515)
(UK) experimental		-6,331*** (1,900)	-6,767*** (1,902)	-6,685*** (2,326)	-7,635*** (2,514)	-7,743*** (2,773)
US control				72.56 (3,113)	-17,515** (8,768)	-17,261* (8,968)
US experimental				-152.5 (3,929)	1,178 (3,916)	1,057 (4,638)
PD reaction time (round 2)		1.396*** (0.503)	0.982* (0.559)	0.982* (0.561)	0.966* (0.570)	0.977* (0.583)
Age					-2,527 (1,990)	-2,280 (2,436)
Gender						-1,203 (3,843)
Education					3,288	3,144

					(2,501)	(3,249)
Time in UK					-611.6 (439.5)	-596.4 (439.5)
Time in US					204.1 (365.3)	182.5 (357.5)
Participant familiarity						37.39 (1,666)
GT familiarity					2,192* (1,126)	2,366 (1,476)
Period 2 indicator			-16,010*** (5,573)	-16,012*** (5,604)	-15,979*** (5,664)	-15,924*** (5,682)
Period 3 indicator			-16,012*** (5,522)	-16,013*** (5,551)	-16,016*** (5,624)	-15,947*** (5,612)
Period 4 indicator			-17,472*** (5,829)	-17,474*** (5,857)	-17,373*** (5,987)	-17,321*** (5,981)
Period 5 indicator			-16,602*** (5,788)	-16,603*** (5,818)	-16,517*** (5,897)	-16,455*** (5,883)
Constant	11,843*** (1,498)	7,063*** (2,549)	21,576*** (6,630)	21,533*** (6,911)	71,038* (36,080)	66,541 (42,175)
Summary Statistics						
R^2	0.008	0.292	0.383	0.383	0.401	0.402

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Table 9: Data 2 Regression Results w/ Dependent Variable *PD reaction time (round 1)*

Looking at reaction time as our dependent variable of interest, interesting results emerge. Understandably, the first period faces the longest decision time which then slowly increases as the periods progress up to the final, fifth one. The more cooperative players are, the faster they tend to come to that decision; heterogenous pairs in particular leaped on decisions, as did American controls relative to homogenous Brits. Americans in heterogenous interestingly took longer. The more familiar a participant with game theory, the longer they took to come to a decision; the same effect exists for education level. This backs up the idea that cooperative decisions tend to be instinctive and faster than deceptive behaviour.

Regressors	(1)	(2)	(3)	(4)	(5)	(6)
Diff PD move	-4,154* (2,343)	-3,680 (2,344)	-1,519 (2,564)	-1,515 (2,524)	-2,343 (2,569)	-2,191 (2,745)
(UK) experimental		-6,574*** (2,076)	-6,754*** (2,026)	-6,675*** (2,320)	-7,422*** (2,658)	-7,741*** (2,778)
US control				69.50 (3,132)	-15,036** (6,672)	-17,234* (9,037)
US experimental				-146.2 (3,983)	1,356 (3,606)	1,016 (4,323)
Age					-2,586 (1,845)	-2,216 (2,172)
Gender						-1,269 (3,689)
Education					3,759*	3,085

					(2,222)	(2,877)
Time in UK					-616.2 (388.0)	-600.6 (404.6)
Time in US						177.7 (358.5)
Participant familiarity					510.9 (1,035)	10.97 (1,629)
GT familiarity					2,159** (1,080)	2,384* (1,258)
Period 2 indicator			-15,884*** (5,492)	-15,884*** (5,515)	-15,740*** (5,437)	-15,766*** (5,480)
Period 3 indicator			-15,866*** (5,359)	-15,867*** (5,381)	-15,742*** (5,298)	-15,765*** (5,332)
Period 4 indicator			-17,331*** (5,657)	-17,332*** (5,674)	-17,104*** (5,626)	-17,146*** (5,678)
Period 5 indicator			-16,444*** (5,571)	-16,445*** (5,589)	-16,217*** (5,500)	-16,259*** (5,548)
Constant	6,752*** (1,434)	9,168*** (1,900)	21,373*** (5,318)	21,331*** (5,084)	70,463** (32,317)	65,277* (36,812)
Summary Statistics						
R^2	0.016	0.052	0.196	0.196	0.220	0.221

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10: Data 2 Regression Results w/ Dependent Variable *Diff in PD reaction time*

We see similar results for difference in decision-making time rather than simply looking at the results from the first round: interestingly, the final period bucks the trend here, taking less time than the penultimate period 4 but more than the rest showing how a final round often forces participants to more seriously contend with their decisions. Effects on familiarity with game theory, education, target group, and nationality are all supported by this analysis, which shows more meaningful statistical significance in the "true" regression 5 that strips out variables close to 0 or theoretically meaningless. Interestingly, those who spent less time in the UK tended to come to decisions faster; this effect is not statistically significant, but interesting to mention.

The prisoner's dilemma shows us an interesting combination of effects, largely affirming our conclusions from the broader regression about the increased cooperativity between heterogeneous pairs: these decisions tend to come faster and more instinctively and demonstrate effects by nationality and pairing as well—the slower-acting Brits must contend with American impulsivity that tends towards cooperative behaviour as well. All further regression analysis will be through the UG, which we hope to confirm these results.

Regressor	(1)	(2)	(3)	(4)	(5)
(UK) experimental	0.0257 (0.0528)	0.0255 (0.0525)	-0.0548 (0.0678)	-0.0970 (0.0716)	-0.0693 (0.0660)
US control			-0.206*** (0.0618)	-1.098*** (0.312)	-0.940*** (0.297)
US experimental			0.124	0.207**	0.136

			(0.105)	(0.104)	(0.0967)
UG cc (round 2)	0.0569 (0.100)	0.0418 (0.0970)	-0.0211 (0.0969)	0.0181 (0.0956)	0.291*** (0.107)
Player role (round 1)	-0.000437 (0.0516)	0.000585 (0.0513)	0.0130 (0.0535)	0.0484 (0.0540)	0.0808 (0.0499)
Age				-0.0669 (0.0517)	-0.0623 (0.0557)
Gender				-0.0959 (0.0602)	-0.0543 (0.0677)
Education				0.0846 (0.0733)	0.0758 (0.0790)
Time in UK				-0.00645 (0.0109)	-0.00549 (0.0101)
Time in US				0.0365*** (0.0131)	0.0318*** (0.0116)
Participant familiarity					0.0122 (0.0383)
GT familiarity				0.0668** (0.0295)	0.0450 (0.0286)
Diff in earnings					0.00445*** (0.000929)
Period 2 indicator		-0.0887 (0.0762)	-0.0884 (0.0734)	-0.0886 (0.0703)	-0.0270 (0.0684)
Period 3 indicator		-0.0535 (0.0728)	-0.0520 (0.0714)	-0.0529 (0.0697)	-0.00584 (0.0659)
Period 4 indicator		-0.0716 (0.0756)	-0.0737 (0.0740)	-0.0724 (0.0704)	-0.0272 (0.0636)
Period 5 indicator		-0.183** (0.0833)	-0.185** (0.0817)	-0.184** (0.0784)	-0.113 (0.0715)
Constant	0.727*** (0.0796)	0.817*** (0.0894)	0.977*** (0.0926)	2.104*** (0.808)	1.720* (0.876)
Summary Statistics					
R^2	0.003	0.030	0.080	0.187	0.319

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 11: Data 2 Regression Results w/ Dependent Variable *UG cc (round 1)*

UG round 1 strategies show us unique results that somewhat match previous outcomes. Interestingly, we see that American controls are significantly less cooperative, while American heterogenous pairs are much more cooperative. This points to a potential culprit or our fleeting significance—a small number of British controls (just 10 participants) that make comparisons to the group difficult. Likely tied to Americanisms, time in the US tends to increase cooperative behaviour. Game theorists tended to be more cooperative in this game, possibly because of the stark unpopularity of the pure economical strategy of a 99/1 split—the ultimatum game is also less studied than the classical prisoner's dilemma and so can allow individual gameplay styles to dominate. However, theoretical economists still have room to rejoice: period 5 shows a consistently lower cc showing how individuals deviate once the reputational costs are especially low—period 1 appears to be the most cooperative of the five repetitions.

Regression	(1)	(2)	(3)	(4)	(5)
(UK) experimental	0.0380 (0.0629)	0.0380 (0.0629)	-0.0747 (0.0805)	-0.136* (0.0810)	-0.0833 (0.0670)
US control			-0.111 (0.0779)	-0.783** (0.371)	-0.660** (0.315)
US experimental			0.207 (0.127)	0.321** (0.126)	0.154 (0.106)
Player role (round 1)	-0.0640 (0.0622)	-0.0640 (0.0625)	-0.0735 (0.0654)	-0.0344 (0.0625)	0.0515 (0.0528)
Age				-0.185*** (0.0667)	-0.121** (0.0605)
Gender					-0.00890 (0.0741)
Education				0.206** (0.0952)	0.134 (0.0847)
Time in UK				0.0196 (0.0134)	0.0107 (0.0112)
Time in US				0.0496*** (0.0144)	0.0369*** (0.0123)
Participant familiarity				-0.0171 (0.0364)	0.000809 (0.0376)
GT familiarity				0.0460 (0.0310)	0.0274 (0.0325)
Diff in earnings					0.00671*** (0.000923)
Period 2 indicator		-0.0930 (0.0948)	-0.0930 (0.0940)	-0.0930 (0.0900)	0.00183 (0.0782)
Period 3 indicator		-0.0755 (0.0949)	-0.0755 (0.0959)	-0.0755 (0.0941)	0.00506 (0.0796)
Period 4 indicator		-0.0400 (0.102)	-0.0400 (0.102)	-0.0400 (0.0938)	0.0147 (0.0768)
Period 5 indicator		-0.138 (0.0935)	-0.138 (0.0922)	-0.138 (0.0879)	-0.0504 (0.0751)
Constant	0.0750 (0.0484)	0.144** (0.0706)	0.214*** (0.0804)	2.964*** (1.070)	1.901* (0.970)
Summary Statistics					
R^2	0.007	0.019	0.033	0.156	0.414

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Table 12: Data 2 Regression Results w/ Dependent Variable *Diff in UG cc*

We see similar trends when looking at the inter-round difference in cc. British controls and American heterogeneous pairs are the most cooperative, followed by British experimental pairs and finally American controls. Younger and more educated people tend to be more cooperative, as we observed in the by-participant data and without significance in prior analyses. Time in the US, like last time, remains both positive and significant.

Regressor	(1)	(2)	(3)	(4)	(5)	(6)
Diff UG cc	-11,176* (6,037)	-11,527* (6,059)	-11,915** (5,616)	-12,339** (5,726)	-13,345* (7,160)	-14,242* (8,016)
(UK) experimental		9,774** (4,749)	9,315* (4,867)	5,952 (5,659)	11,127* (6,247)	10,757* (6,103)
US control				-2,743 (2,317)	-9,239* (5,301)	-15,250 (19,597)
US experimental				6,249 (8,595)	16,556* (9,794)	17,674* (10,463)
UG reaction time (round 2)		0.365** (0.167)	0.0722 (0.209)	0.0560 (0.217)	0.0578 (0.235)	0.0554 (0.240)
Player role (round 1)	5,452 (3,879)	5,094 (3,765)	5,338 (3,708)	4,976 (3,092)	4,247 (3,297)	4,064 (3,373)
Age					-10,917** (5,235)	-11,272** (5,531)
Gender					22,417*** (7,931)	22,319*** (7,838)
Education					11,410** (5,406)	11,129** (5,335)
Time in UK						215.5 (660.7)
Time in US						590.7 (922.4)
Participant familiarity					8,380*** (2,913)	8,104*** (2,755)
GT familiarity					-6,263** (2,494)	-6,351** (2,585)
Diff in earnings					41.53 (71.39)	42.34 (71.83)
Period 2 indicator			-9,007** (4,468)	-9,162** (4,479)	-8,656** (4,319)	-8,745** (4,338)
Period 3 indicator			-7,694 (4,897)	-7,877 (4,920)	-7,438 (4,873)	-7,518 (4,924)
Period 4 indicator			-16,451*** (3,280)	-16,616*** (3,329)	-16,302*** (3,868)	-16,353*** (3,902)
Period 5 indicator			-7,631 (8,161)	-7,847 (8,164)	-7,427 (8,289)	-7,563 (8,208)
Constant	18,225*** (2,871)	10,986*** (3,208)	22,056*** (5,800)	24,167*** (5,830)	199,743** (86,042)	203,918** (89,503)
Summary Statistics						
R^2	0.044	0.079	0.109	0.112	0.207	0.209

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 13: Data 2 Regression Results w/ Dependent Variable *UG reaction time (round 1)*

There is a weak, but 10% significant, inverse correlation between reaction time and cooperative behaviour—going from fully competitive to fully cooperative behaviour is liked to 13.4 second decrease in decision time. Heterogenous groups take longer to decide (11.1 sec for Brits and 16.6 sec for Americans), while homogenous pairs come to their decision faster, controlling for cooperative behaviour. Those younger decide faster, while more education leads to longer decision time. Men take longer than women, more familiar participants generally take longer to make decision, and those self-proclaimed to know game theory make faster decisions as well. The first period takes the longest time to decide, with the penultimate repetition leading to the fastest reaction. Here we are presented with an important distinction: homogenous pairs make faster decisions, which are also linked to more cooperative behaviour.

Regressor	(1)	(2)	(3)	(4)	(5)	(6)
Diff UG cc	-10,861* (6,074)	-11,377* (6,082)	-11,077* (5,697)	-11,355* (5,822)	-13,497* (7,269)	-14,335* (8,085)
(UK) experimental		10,798** (4,767)	10,787** (4,763)	8,268 (6,071)	13,400** (6,541)	12,910** (6,410)
US control				-995.0 (2,790)	-5,847 (5,902)	-3,897 (21,963)
US experimental				4,894 (8,909)	14,820 (9,945)	15,824 (10,580)
Player role (round 1)	4,552 (3,942)	4,519 (3,882)	4,538 (3,887)	4,130 (3,310)	3,518 (3,519)	3,350 (3,586)
Age					-11,113** (5,263)	-11,709** (5,497)
Gender					22,051*** (7,878)	21,836*** (7,794)
Education					10,620* (5,574)	10,805** (5,383)
Time in UK						582.4 (817.0)
Time in US						497.0 (906.2)
Participant familiarity					8,368*** (2,920)	8,063*** (2,768)
GT familiarity					-6,026** (2,552)	-6,249** (2,624)
Diff in earnings					67.13 (71.82)	67.29 (72.37)
Period 2 indicator			-2,322 (4,883)	-2,348 (4,916)	-1,599 (4,786)	-1,675 (4,822)
Period 3 indicator			975.6 (4,775)	954.6 (4,786)	1,598 (4,751)	1,537 (4,813)
Period 4 indicator			-7,956** (3,292)	-7,967** (3,323)	-7,506** (3,674)	-7,538** (3,742)
Period 5 indicator			1,484 (7,217)	1,446 (7,251)	2,026 (7,226)	1,913 (7,184)
Constant	8,980***	4,708**	6,249*	7,064*	187,010**	188,801**

	(2,973)	(2,295)	(3,625)	(3,980)	(88,400)	(92,269)
Summary Statistics						
R^2	0.038	0.073	0.088	0.090	0.185	0.188

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 14: Data 2 Regression Results w/ Dependent Variable *Diff in UG reaction time*

Looking at the difference between reaction time, we see the same effects with a lower R^2 and significance. Homogenous pairs, here, also take longer to come to decisions while cooperative behaviour seems to be more instinctive and be faster. Effects on game theory and participant familiarity, periodical effects, age, gender, and education are all affirmed in this analysis as well. Responding players, as with the previous analysis, take slightly longer to come to decisions but not substantially. Second players also took longer to come to a decision here.

Ultimately, the weakness with conclusions from the ultimatum game is the lack of direct comparability between actual move strategy in the cc—proposing players have a considerable advantage given the game's sliding scale decision for the first player, leaving responding players' binary response decision incomparable. To make the direct comparison between not the cc, but the richer data contained in the moves from the game as well, a third dataset was generated looking at the case where participants were the proposing player in both rounds of the UG.

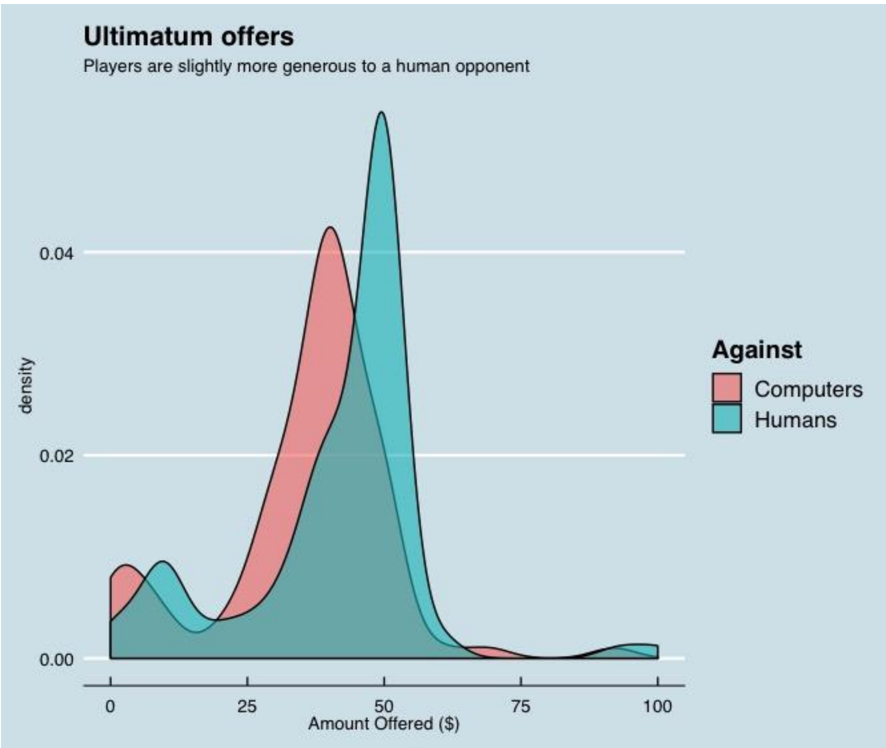

Figure 7: Distribution of ultimatum game moves by round (dataset 3)

This data shows us that individuals are particularly loathe to deviate from 50-50: a sizeable minority did the illogical thing and offered more than $50 to their opponents. Players were much more comfortable offering the computer measly amounts of money, but ultimately peaked around $40—a reasonable conclusion given that the bot would not accept less than that amount. A t-test in differences found that Britons are consistently more generous in their offers at the 1% level, with 5% level evidence that heterogenous groups provided better offers to their peers.

Variable	**Mean**	**Std Dev**	**Min**	**Max**
ID	306,063	9,925	263,038	308,947
Nationality	0.500	0.503	0	1
Age	19.80	1.255	18	22
Gender	0.550	0.500	0	1
Education	2.500	1.124	1	4
Time in UK	9.228	9.246	0.0110	21
Time in US	9.352	9.426	0	21
Participant familiarity	1.850	1.067	1	4
GT familiarity	2.700	1.010	1	4
Target group indicator	0.400	0.492	0	1
Group #	10.50	5.795	1	20
Period	3	1.421	1	5
PD move (round 1)	0.820	0.386	0	1
PD move (round 2)	0.360	0.482	0	1
PD reaction time (round 1)	10,805	19,630	1,114	158,837
PD reaction time (round 2)	5,473	6,707	1,000	38,473
UG player role (round 2)	0	0	0	0
UG move (round 2)	35.76	15.51	0	92
UG payoff (round 2)	30.57	27.97	0	60
UG reaction time (round 2)	9,216	7,067	341	49,190
UG player role (round 1)	0	0	0	0
UG move (round 1)	41.17	16.65	0	100
UG payoff (round 1)	42.51	25.96	0	100
UG reaction time (round 1)	17,217	25,742	3,263	226,121
UG cc (round 2)	0.686	0.281	0	1
UG cc (round 1)	0.777	0.303	0	1

Table 15: Summary Statistics for Dataset 3 (N = 100)

On other metrics, the data appears broadly similar to the overarching dataset. Shrunk to just 100 participants, they were equally divided by nationality and 40% were in the target group. PD moves and other time variables broadly line up, as do the UG move and cc variables, with small differences in statistics like UG cc in round 1. Standard errors are interestingly diminished as well.

Regressor	(1)	(2)	(3)	(4)	(5)
(UK) experimental	4.317 (3.273)	4.279 (3.282)	1.655 (2.736)	-0.776 (3.124)	-2.286 (4.201)
US control			-10.27*** (3.528)	-7.051 (5.440)	-3.875 (45.60)
US experimental			1.588 (6.998)	-6.985 (5.860)	-4.290 (7.101)

UG move (round 2)	0.269* (0.147)	0.276* (0.151)	0.255 (0.161)	0.260* (0.141)	0.290* (0.147)
Age				-1.974 (1.656)	-3.440 (4.592)
Gender				-11.50*** (3.395)	-11.66** (4.436)
Education					1.921 (5.577)
Time in UK					0.593 (0.910)
Time in US					0.327 (1.699)
Participant familiarity				-2.521 (2.378)	-2.521 (2.746)
GT familiarity				4.574*** (1.496)	4.255** (1.810)
Period 2 indicator		-0.999 (4.787)	-0.950 (4.277)	-0.961 (4.314)	-1.032 (4.306)
Period 3 indicator		-0.747 (4.635)	-0.709 (4.288)	-0.718 (4.374)	-0.773 (4.395)
Period 4 indicator		4.104 (5.126)	4.081 (4.943)	4.086 (4.729)	4.119 (4.811)
Period 5 indicator		-1.212 (5.449)	-1.222 (5.189)	-1.220 (4.973)	-1.205 (5.042)
Constant	29.82*** (5.480)	29.35*** (6.574)	36.04*** (6.954)	74.24** (32.47)	88.43 (69.64)
Summary Statistics					
R^2	0.090	0.104	0.186	0.294	0.298

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 16: Data 3 Regression Results w/ Dependent Variable *UG move (round 1)*

Jumping straight into analysis then, looking at the numbers paints an interesting picture. Participants were weakly more generous in the first round, with the effects deteriorating over time; interestingly players more familiar with GT actually offered $5 on average for each level increase in familiarity (of which there are 3). Men are less generous than women, and there is a strong positive relationship between moves in both rounds of the game. On our variables of interest, British controls were the most generous, followed by British experimental participants; Americans in heterogeneous pairs lagged behind with substantially less offered beaten only by their homogenous counterparts who proved the most punitive.

Regressor	(1)	(2)	(3)	(4)	(5)
(UK) experimental	0.400 (3.860)	0.400 (3.857)	1 (4.252)	-7.304 (5.165)	-8.028 (5.392)
US control			-6.360 (5.233)	-19.86 (35.36)	-8.424 (41.61)
US experimental			-5.133	-2.762	-1.732

			(7.813)	(8.391)	(9.115)
Age				-1.589	-4.255
				(1.747)	(5.582)
Gender				-15.49***	-14.49**
				(5.696)	(6.419)
Education					3.955
					(7.527)
Time in UK				1.834**	2.175*
				(0.907)	(1.100)
Time in US				2.541**	2.103
				(1.260)	(1.529)
Participant familiarity				-5.245*	-4.533
				(2.649)	(2.954)
GT familiarity				5.475**	4.889*
				(2.367)	(2.507)
Period 2 indicator		-2.700	-2.700	-2.700	-2.700
		(6.168)	(5.812)	(5.572)	(5.611)
Period 3 indicator		-2.050	-2.050	-2.050	-2.050
		(6.170)	(5.908)	(5.639)	(5.714)
Period 4 indicator		4.900	4.900	4.900	4.900
		(6.301)	(6.244)	(5.791)	(5.833)
Period 5 indicator		-0.850	-0.850	-0.850	-0.850
		(5.941)	(5.714)	(5.414)	(5.458)
Constant	5.250*	5.390	9.100*	13.04	51.03
	(2.669)	(4.126)	(4.831)	(35.35)	(84.51)
Summary Statistics					
R^2	0.000	0.019	0.068	0.231	0.233

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 17: Data 3 Regression Results w/ Dependent Variable *Diff in UG moves*

Significance was fleeting in an analysis of difference in offers: the broad trends are the similar, nonetheless. British controls were the most generous followed by American experimental participants; after a small drop-off, British experimental participants proved less cooperative followed by a steeper difference with American controls. However, the SE for these estimates remains as large as in previous analysis giving us little confidence in such results. Men are certainly more punitive than women, however, and more time either the US and UK links to increased cooperative behaviour: this likely refers to the assimilation effects for Americans and Britons alike. Participant familiarity with their partner lead to more punitive offers, contrary to the visible cooperation in PD outcomes but understandable given the zero-sum nature of such a game. On the other hand, knowing more about GT is confirmed here to lead to more cooperative outcomes.

In all, our results were a mixed bag of outcomes. Heterogenous pairs generally tended to be more cooperative, though homogenous pairs ended up making decisions faster, as did more cooperative groups. There was a consistent inverse relationship with age and positive one with education; partner familiarity lead to more competition in the UG and cooperation in the PD; the converse was true for game theory familiarity.

Discussion

Breaking with past literature on cultural differences, this study shows a potential for an understudied causal pathway. In part, heterogenous pairs cooperate because they're more familiar with their own cultural schema and thus are less adept at reading cues from their partner. Americans may also be particularly bubbly or outgoing, a long-observed trend, accentuating their cooperative behaviour along with other attributes out of a sense of "American excellence" or something along those lines. Additionally, Brits may find Americans to be friendly and thus more trustworthy, while Americans trust the less vocal British, associating their compatriots' gregariousness with impending deviation and untrustworthiness. The continuing economic significance of time spent in the UK and US affirms as much. Future analysis may want to further look at a single variable—time spent out of home country and time spent in target country. Such an analysis might make more sense if these effects are anticipated.[25]

As hypothesised, the results were starker between British participants, despite the fact that just 10 British controls participated in the study. The final results on this breakdown is unclear. Americans, nonetheless, are certainly more competitive than their British peers, though there is an unclear differentiation between their behaviour depending on pair homogeneity. As expected, for datasets 2 and 3, the by-round analysis, looking at differences appears to be substantially less significant due to the diminishing within-round correlation. Ultimately, the analysis is limited by the small sample size and small effect size: with small effects that approach 0, substantially more data is needed to reduce the sample size to exclude 0 from the confidence interval at a 5% level.

Conceptually, there are familiarity effects that are relevant in this case. People who know each other have differing cooperativity, though results are mixed: ultimatum game outcomes show increased competition while prisoner's dilemma behaviour reflects increased cooperation by familiar individuals. On one hand, they may feel more comfortable deviating because of an existing rapport, and thus can push the limits more comfortably. Alternatively, they are less likely to deviate because they are familiar with each other and face longer-term ramifications for deviation. Nonetheless, the differing outcomes ultimately depend on earnings—in the prisoner's dilemma, cooperation benefits both players and familiarity, allowing them to reach a pareto optimal equilibrium while in the ultimatum game, the zero-sum nature of splitting the pot pits former acquaintances against each other, where they are more comfortable taking more self-interested steps.

There is some omitted variable bias we should be concerned about: on one hand, earnings after round 1 include individual projections of future earnings and their own risk-aversity and thus affect future behaviour; practice effects were unavoidable and built into the computer-player metric thus likely not encapsulating the true participant strategy if presented with the game for the first time. Confounding variables of perceived ethnicity or race may likely affect behaviour as well, implying that individuals are on general more cooperative except against perceived ethic/racial out-groups.

[25] This could be included in a future, supplemental analysis of the data when more time is allocated.

A few other concerns arose during the implementation of the study. A few trials had no conversation between participants at all, making it impossible to have accent or nationality effects. Future trials may include some sort of introduction or icebreaker task designed to avoid priming for cooperative outcomes, given we are still unclear to what extent familiarity impacted outcomes. Some other participants failed to understand the instructions and sought no further clarification, leading to confusing results like a proposing player offering $92 to their opponent in the first round of the ultimatum game—these could go either way in their influence on the cooperative effect. Other participants did not care about the incentive (not everyone loves chocolate) while others failed to recognise that there was one to begin with: both of these weakened the competitive incentives and accentuated cooperative behaviour. In future replications of the study, monetary incentives would be a substantially more valuable incentive. In another case, players were confused about when they were playing against a computer versus their direct human opponent: this likely accentuated competitive behaviour at the expense of cooperation. Finally, another group was confused about the ultimatum game and were under the impression that they had to, by design, come to a consensus decision to divide the pot. This last example would have increased cooperation. Ultimately, the various confusions lead to an uncertain effect due to an indeterminate magnitude of the effects of interest—future iterations of the study may attempt to clarify and explicitly avoid such issues.

There are also questions of external validity and the generalisability of results. For one, almost all participants were students or visitors at the University of Cambridge, an affiliation with which may have created confounding effects and minimise the effects as well by decreasing the difference between groups. Of the Americans, all but 4 (so 18/22 or 82%) were on the Pembroke College Fall Semester Programme; a substantial amount of the British participants were also in Pembroke, leaving to familiarity effects—though an indicator exists to control for such behaviour, it likely does not truly encapsulate the true effect in its 4 levels. Many participants were familiar with others, and a good amount had some familiarity with game theory, both shown to have correlated with game-playing behaviour.

On the limitations of the ultimatum game, a consideration of the procedure may eliminate the comparability issues in future designs. A better methodology would have included 10 rounds of the ultimatum game with alternating proposing and responding players—an even number of rounds would make it so that no player held each position for more than 5 times; this could be supplemented with a similar 5-round prisoner's dilemma with $200/$100 (Push/Pull) values, respectively, to equalise the earnings between games.

Ultimately, though we have some results it is still too soon to say the true effect of accent effects on behavioural outcomes. There is clearly a difference between homogenous and heterogenous groups and especially between nationality. Future social policymakers may want to further examine these behaviours as proxies for broader propensity for cooperative behaviour, important to keep in mind given the world's increasing globalisation and rising interpersonal interaction. Another form of this study, which looks at a mere national identifier or only audio communication instead of in-person games may serve to be particularly generalisable and avoid confounding factors that arise with our design. Such a design may also be applicable for determining various intranational effects, whether it be a North/South distinction in the UK or a comparison of AAVE and Standard American English in the US.

Appendix: Stata Do File For T-tests

```
-------------------------------------------------------------------------------
      name:  <unnamed>
       log:  /Users/mishat/Desktop/Data/Li16/li6.log
  log type:  text
 opened on:   9 Dec 2019, 11:17:21

.  import delimited "/Users/mishat/Desktop/Data/Li16/findat.csv"
(32 vars, 40 obs)
.  ttest dpdcc = 0

One-sample t test
------------------------------------------------------------------------------
Variable |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
   dpdcc |      40         .45    .0484371    .3063432    .3520267    .5479733
------------------------------------------------------------------------------
    mean = mean(dpdcc)                                            t =   9.2904
Ho: mean = 0                                     degrees of freedom =       39

    Ha: mean < 0                 Ha: mean != 0                 Ha: mean > 0
 Pr(T < t) = 1.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 0.0000

.  ttest dpdcc, by(tg)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      24    .4166667     .069069    .3383678    .2737865    .5595469
       1 |      16          .5    .0632456    .2529822    .3651953    .6348047
---------+--------------------------------------------------------------------
combined |      40         .45    .0484371    .3063432    .3520267    .5479733
---------+--------------------------------------------------------------------
    diff |           -.0833333    .0992479               -.2842502    .1175835
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =  -0.8396
Ho: diff = 0                                     degrees of freedom =       38

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.2032         Pr(|T| > |t|) = 0.4064          Pr(T > t) = 0.7968

.  ttest dpdcc, by(nat)
```

Two-sample t test with equal variances

```
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      18    .3222222    .0400617    .1699673    .2376995    .406745
       1 |      22    .5545455    .0755148    .3541956    .3975039    .711587
---------+--------------------------------------------------------------------
combined |      40         .45    .0484371    .3063432    .3520267    .5479733
---------+--------------------------------------------------------------------
    diff |           -.2323232     .091151               -.4168487   -.0477978
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =  -2.5488
Ho: diff = 0                                     degrees of freedom =       38

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0075         Pr(|T| > |t|) = 0.0150          Pr(T > t) = 0.9925
```

. ttest dugcc, by(tg)

Two-sample t test with equal variances

```
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      24        .043    .0682337    .3342756   -.0981522    .1841522
       1 |      16        .081    .0668047    .2672188   -.0613908    .2233908
---------+--------------------------------------------------------------------
combined |      40       .0582    .0484038    .3061328    -.039706    .156106
---------+--------------------------------------------------------------------
    diff |               -.038    .0999055               -.2402482    .1642482
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =  -0.3804
Ho: diff = 0                                     degrees of freedom =       38

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.3529         Pr(|T| > |t|) = 0.7058          Pr(T > t) = 0.6471
```

. ttest dugcc, by(nat)

Two-sample t test with equal variances

```
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      18    .0788889    .0594492    .2522214   -.0465379    .2043156
       1 |      22    .0412727    .0744315    .3491146    -.113516    .1960614
```

```
---------+--------------------------------------------------------------------
combined |      40       .0582    .0484038    .3061328    -.039706     .156106
---------+--------------------------------------------------------------------
    diff |            .0376162    .0983782               -.1615401    .2367724
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =   0.3824
Ho: diff = 0                                     degrees of freedom =       38

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.6478         Pr(|T| > |t|) = 0.7043          Pr(T > t) = 0.3522

.  ttest dugcc if (role == 0), by(tg)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      12    .1043333    .1055668    .3656942   -.1280177    .3366843
       1 |       8        .069    .1004269    .2840503    -.168472     .306472
---------+--------------------------------------------------------------------
combined |      20       .0902    .0733025    .3278189    -.063224     .243624
---------+--------------------------------------------------------------------
    diff |            .0353333    .1535026               -.2871636    .3578303
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =   0.2302
Ho: diff = 0                                     degrees of freedom =       18

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.5897         Pr(|T| > |t|) = 0.8205          Pr(T > t) = 0.4103

.  ttest dugcc if (role == 0), by(nat)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      10        .178     .071966    .2275766    .0152015    .3407985
       1 |      10       .0024    .1256778    .3974282    -.281903     .286703
---------+--------------------------------------------------------------------
combined |      20       .0902    .0733025    .3278189    -.063224     .243624
---------+--------------------------------------------------------------------
    diff |               .1756    .1448241               -.1286642    .4798642
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =   1.2125
```

```
Ho: diff = 0                              degrees of freedom =       18

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.8795         Pr(|T| > |t|) = 0.2410          Pr(T > t) = 0.1205

.  clear
.  import delimited "/Users/mishat/Desktop/Data/Li16/rddat.csv"
(27 vars, 200 obs)
.  ttest dpdmove == 0

One-sample t test
------------------------------------------------------------------------------
Variable |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
 dpdmove |     200         .45    .0373426    .5281046    .3763619    .5236381
------------------------------------------------------------------------------
    mean = mean(dpdmove)                                          t =  12.0506
Ho: mean = 0                                     degrees of freedom =      199

    Ha: mean < 0                 Ha: mean != 0                 Ha: mean > 0
 Pr(T < t) = 1.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 0.0000

.  ttest dugcc == 0

One-sample t test
------------------------------------------------------------------------------
Variable |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
   dugcc |     200       .0582    .0310727     .439434    -.003074     .119474
------------------------------------------------------------------------------
    mean = mean(dugcc)                                            t =   1.8730
Ho: mean = 0                                     degrees of freedom =      199

    Ha: mean < 0                 Ha: mean != 0                 Ha: mean > 0
 Pr(T < t) = 0.9687         Pr(|T| > |t|) = 0.0625          Pr(T > t) = 0.0313

.  ttest dpdmove, by(tg)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |     120    .4166667    .0481933    .5279313    .3212391    .5120942
       1 |      80          .5    .0590001     .527713    .3825632    .6174368
```

```
---------+--------------------------------------------------------------------
combined |     200        .45    .0373426    .5281046    .3763619    .5236381
---------+--------------------------------------------------------------------
    diff |          -.0833333    .0761878             -.2335769    .0669102
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                  t =  -1.0938
Ho: diff = 0                                 degrees of freedom =      198

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.1377         Pr(|T| > |t|) = 0.2754          Pr(T > t) = 0.8623

.  ttest dugcc, by(tg)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |     120        .043    .0411022    .4502522   -.0383865    .1243865
       1 |      80        .081    .0474567    .4244657   -.0134602    .1754602
---------+--------------------------------------------------------------------
combined |     200       .0582    .0310727     .439434    -.003074     .119474
---------+--------------------------------------------------------------------
    diff |               -.038    .0635294             -.1632812    .0872812
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                  t =  -0.5981
Ho: diff = 0                                 degrees of freedom =      198

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.2752         Pr(|T| > |t|) = 0.5504          Pr(T > t) = 0.7248

.  ttest dpdmove, by(nat)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      90    .3222222    .0519958    .4932756    .2189076    .4255368
       1 |     110    .5545455    .0509892    .5347788    .4534866    .6556043
---------+--------------------------------------------------------------------
combined |     200        .45    .0373426    .5281046    .3763619    .5236381
---------+--------------------------------------------------------------------
    diff |          -.2323232    .0734172             -.3771033   -.0875432
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                  t =  -3.1644
```

```
Ho: diff = 0                              degrees of freedom =      198

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0009         Pr(|T| > |t|) = 0.0018          Pr(T > t) = 0.9991

.  ttest dugcc, by(nat)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      90    .0788889    .0390235    .3702093    .0013501    .1564277
       1 |     110    .0412727    .0467094    .4898925   -.0513038    .1338493
---------+--------------------------------------------------------------------
combined |     200       .0582    .0310727     .439434    -.003074     .119474
---------+--------------------------------------------------------------------
    diff |            .0376162    .0625589               -.085751    .1609833
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =   0.6013
Ho: diff = 0                              degrees of freedom =      198

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.7258         Pr(|T| > |t|) = 0.5483          Pr(T > t) = 0.2742

.  ttest dugcc if (role == 0), by(tg)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      60    .1043333    .0532728     .412649   -.0022652    .2109319
       1 |      40        .069    .0571949    .3617323   -.0466876    .1846876
---------+--------------------------------------------------------------------
combined |     100       .0902    .0391573    .3915728    .0125035    .1678965
---------+--------------------------------------------------------------------
    diff |            .0353333    .0802569              -.1239339    .1946006
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =   0.4403
Ho: diff = 0                              degrees of freedom =       98

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.6696         Pr(|T| > |t|) = 0.6607          Pr(T > t) = 0.3304

.  ttest dugcc if (role == 0), by(nat)
```

```
Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      50        .178    .0421591    .2981097    .0932782    .2627218
       1 |      50       .0024    .0640603    .4529746   -.1263339    .1311339
---------+--------------------------------------------------------------------
combined |     100       .0902    .0391573    .3915728    .0125035    .1678965
---------+--------------------------------------------------------------------
    diff |               .1756    .0766884                .0234144    .3277856
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =   2.2898
Ho: diff = 0                                     degrees of freedom =       98

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.9879         Pr(|T| > |t|) = 0.0242          Pr(T > t) = 0.0121

.
.  ttest pdmv1 == 0

One-sample t test
------------------------------------------------------------------------------
Variable |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
   pdmv1 |     200        .815    .0275257     .389272    .7607205    .8692795
------------------------------------------------------------------------------
    mean = mean(pdmv1)                                            t =  29.6087
Ho: mean = 0                                     degrees of freedom =      199

    Ha: mean < 0                 Ha: mean != 0                 Ha: mean > 0
 Pr(T < t) = 1.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 0.0000

.  ttest ugcc1 == 0

One-sample t test
------------------------------------------------------------------------------
Variable |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
   ugcc1 |     200       .7783    .0256888    .3632947    .7276428    .8289572
------------------------------------------------------------------------------
    mean = mean(ugcc1)                                            t =  30.2972
Ho: mean = 0                                     degrees of freedom =      199
```

```
    Ha: mean < 0                 Ha: mean != 0                 Ha: mean > 0
 Pr(T < t) = 1.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 0.0000

.  ttest pdmv1, by(tg)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |     120    .7583333    .0392433    .4298883    .6806278    .8360389
       1 |      80          .9    .0337526    .3018928    .8328171    .9671829
---------+--------------------------------------------------------------------
combined |     200        .815    .0275257     .389272    .7607205    .8692795
---------+--------------------------------------------------------------------
    diff |           -.1416667    .0554212               -.2509583    -.032375
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =  -2.5562
Ho: diff = 0                                     degrees of freedom =      198

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0057         Pr(|T| > |t|) = 0.0113          Pr(T > t) = 0.9943

.  ttest ugcc1, by(tg)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |     120    .7683333    .0329583    .3610404    .7030726    .8335941
       1 |      80      .79325     .041191    .3684239    .7112613    .8752387
---------+--------------------------------------------------------------------
combined |     200       .7783    .0256888    .3632947    .7276428    .8289572
---------+--------------------------------------------------------------------
    diff |           -.0249167    .0525395               -.1285255    .0786921
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =  -0.4742
Ho: diff = 0                                     degrees of freedom =      198

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.3179         Pr(|T| > |t|) = 0.6358          Pr(T > t) = 0.6821

.  ttest pdmv1, by(nat)

Two-sample t test with equal variances
```

```
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      90    .7777778    .0440683    .4180688     .690215    .8653406
       1 |     110    .8454545    .0346226    .3631252    .7768336    .9140755
---------+--------------------------------------------------------------------
combined |     200        .815    .0275257     .389272    .7607205    .8692795
---------+--------------------------------------------------------------------
    diff |           -.0676768    .0552593               -.1766492    .0412956
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =  -1.2247
Ho: diff = 0                                     degrees of freedom =      198

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.1111         Pr(|T| > |t|) = 0.2221          Pr(T > t) = 0.8889

.  ttest ugcc1, by(nat)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      90    .8624444    .0319563    .3031643    .7989479     .925941
       1 |     110    .7094545    .0375725    .3940634    .6349871     .783922
---------+--------------------------------------------------------------------
combined |     200       .7783    .0256888    .3632947    .7276428    .8289572
---------+--------------------------------------------------------------------
    diff |            .1529899     .050612                .0531821    .2527977
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =   3.0228
Ho: diff = 0                                     degrees of freedom =      198

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.9986         Pr(|T| > |t|) = 0.0028          Pr(T > t) = 0.0014

.  ttest ugcc1 if (role == 0), by(tg)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      60         .77    .0367385    .2845752    .6964864    .8435136
       1 |      40       .7865    .0526205    .3328012     .680065     .892935
---------+--------------------------------------------------------------------
```

```
combined |     100       .7766    .0303249    .3032491    .7164288    .8367712
---------+--------------------------------------------------------------------
    diff |             -.0165    .0621932               -.1399203    .1069203
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =  -0.2653
Ho: diff = 0                                     degrees of freedom =       98

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.3957         Pr(|T| > |t|) = 0.7913          Pr(T > t) = 0.6043

.  ttest ugcc1 if (role == 0), by(nat)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      50       .9124    .0247363    .1749118    .8626906    .9621094
       1 |      50       .6408    .0484906      .34288    .5433546    .7382454
---------+--------------------------------------------------------------------
combined |     100       .7766    .0303249    .3032491    .7164288    .8367712
---------+--------------------------------------------------------------------
    diff |               .2716    .0544354                .1635747    .3796253
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =   4.9894
Ho: diff = 0                                     degrees of freedom =       98

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 1.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 0.0000

.  clear
.  import delimited "/Users/mishat/Desktop/Data/Li16/rddatred.csv"
(27 vars, 100 obs)
.  ttest dugmv == 0

One-sample t test
------------------------------------------------------------------------------
Variable |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
   dugmv |     100        5.41    1.941992    19.41992    1.556667    9.263333
------------------------------------------------------------------------------
    mean = mean(dugmv)                                            t =   2.7858
Ho: mean = 0                                     degrees of freedom =       99

    Ha: mean < 0                 Ha: mean != 0                 Ha: mean > 0
```

```
 Pr(T < t) = 0.9968         Pr(|T| > |t|) = 0.0064          Pr(T > t) = 0.0032

.  ttest dugcc == 0

One-sample t test
------------------------------------------------------------------------------
Variable |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
   dugcc |     100       .0902    .0391573    .3915728    .0125035    .1678965
------------------------------------------------------------------------------
    mean = mean(dugcc)                                            t =   2.3035
Ho: mean = 0                                     degrees of freedom =       99

    Ha: mean < 0                 Ha: mean != 0                 Ha: mean > 0
 Pr(T < t) = 0.9883         Pr(|T| > |t|) = 0.0233          Pr(T > t) = 0.0117

.  ttest dugmv, by(tg)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      60        5.25    2.664649    20.64028   -.0819499    10.58195
       1 |      40        5.65    2.796186    17.68463   -.0058192    11.30582
---------+--------------------------------------------------------------------
combined |     100        5.41    1.941992    19.41992    1.556667    9.263333
---------+--------------------------------------------------------------------
    diff |                 -.4    3.984043               -8.306203    7.506203
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =  -0.1004
Ho: diff = 0                                     degrees of freedom =       98

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.4601         Pr(|T| > |t|) = 0.9202          Pr(T > t) = 0.5399

.  ttest dugcc, by(tg)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      60    .1043333    .0532728     .412649   -.0022652    .2109319
       1 |      40        .069    .0571949    .3617323   -.0466876    .1846876
---------+--------------------------------------------------------------------
```

```
combined |     100      .0902    .0391573    .3915728    .0125035    .1678965
---------+--------------------------------------------------------------------
    diff |           .0353333    .0802569               -.1239339    .1946006
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =   0.4403
Ho: diff = 0                                     degrees of freedom =       98

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.6696         Pr(|T| > |t|) = 0.6607          Pr(T > t) = 0.3304

.  ttest dugmv, by(nat)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      50        9.46     2.07339    14.66108    5.293366    13.62663
       1 |      50        1.36    3.204813    22.66145   -5.080312    7.800312
---------+--------------------------------------------------------------------
combined |     100        5.41    1.941992    19.41992    1.556667    9.263333
---------+--------------------------------------------------------------------
    diff |                 8.1    3.817037                .5252143    15.67479
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =   2.1221
Ho: diff = 0                                     degrees of freedom =       98

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.9818         Pr(|T| > |t|) = 0.0364          Pr(T > t) = 0.0182

.  ttest dugcc, by(nat)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      50        .178    .0421591    .2981097    .0932782    .2627218
       1 |      50       .0024    .0640603    .4529746   -.1263339    .1311339
---------+--------------------------------------------------------------------
combined |     100       .0902    .0391573    .3915728    .0125035    .1678965
---------+--------------------------------------------------------------------
    diff |               .1756    .0766884                .0234144    .3277856
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =   2.2898
Ho: diff = 0                                     degrees of freedom =       98
```

```
    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.9879         Pr(|T| > |t|) = 0.0242          Pr(T > t) = 0.0121

.
.  ttest ugmv1 == 0

One-sample t test
------------------------------------------------------------------------------
Variable |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
   ugmv1 |     100       41.17    1.664851    16.64851    37.86657    44.47343
------------------------------------------------------------------------------
    mean = mean(ugmv1)                                            t =  24.7289
Ho: mean = 0                                     degrees of freedom =       99

    Ha: mean < 0                 Ha: mean != 0                 Ha: mean > 0
 Pr(T < t) = 1.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 0.0000

.  ttest ugcc1 == 0

One-sample t test
------------------------------------------------------------------------------
Variable |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
   ugcc1 |     100       .7766    .0303249    .3032491    .7164288    .8367712
------------------------------------------------------------------------------
    mean = mean(ugcc1)                                            t =  25.6093
Ho: mean = 0                                     degrees of freedom =       99

    Ha: mean < 0                 Ha: mean != 0                 Ha: mean > 0
 Pr(T < t) = 1.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 0.0000

.  ttest ugmv1, by(tg)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      60    38.86667    1.874821     14.5223    35.11516    42.61817
       1 |      40      44.625    3.017192     19.0824    38.52215    50.72785
---------+--------------------------------------------------------------------
combined |     100       41.17    1.664851    16.64851    37.86657    44.47343
---------+--------------------------------------------------------------------
```

```
    diff |          -5.758333    3.365763              -12.43758    .9209143
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =  -1.7109
Ho: diff = 0                                     degrees of freedom =       98

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0451         Pr(|T| > |t|) = 0.0903          Pr(T > t) = 0.9549

.  ttest ugcc1, by(tg)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      60         .77    .0367385    .2845752    .6964864    .8435136
       1 |      40       .7865    .0526205    .3328012     .680065     .892935
---------+--------------------------------------------------------------------
combined |     100       .7766    .0303249    .3032491    .7164288    .8367712
---------+--------------------------------------------------------------------
    diff |              -.0165    .0621932               -.1399203    .1069203
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =  -0.2653
Ho: diff = 0                                     degrees of freedom =       98

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.3957         Pr(|T| > |t|) = 0.7913          Pr(T > t) = 0.6043

.  ttest ugmv1, by(nat)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      50       46.58    1.297121    9.172029    43.97334    49.18666
       1 |      50       35.76    2.884945    20.39964    29.96249    41.55751
---------+--------------------------------------------------------------------
combined |     100       41.17    1.664851    16.64851    37.86657    44.47343
---------+--------------------------------------------------------------------
    diff |               10.82    3.163136                 4.54286    17.09714
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =   3.4207
Ho: diff = 0                                     degrees of freedom =       98

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
```

```
 Pr(T < t) = 0.9995         Pr(|T| > |t|) = 0.0009          Pr(T > t) = 0.0005

.  ttest ugcc1, by(nat)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      50       .9124    .0247363    .1749118    .8626906    .9621094
       1 |      50       .6408    .0484906      .34288    .5433546    .7382454
---------+--------------------------------------------------------------------
combined |     100       .7766    .0303249    .3032491    .7164288    .8367712
---------+--------------------------------------------------------------------
    diff |               .2716    .0544354                .1635747    .3796253
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =   4.9894
Ho: diff = 0                                     degrees of freedom =       98

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 1.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 0.0000

.  log close
      name:  <unnamed>
       log:  /Users/mishat/Desktop/Data/Li16/li6.log
  log type:  text
 closed on:   9 Dec 2019, 11:17:33
------------------------------------------------------------------------------
```