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Center for Research in Economics, Management and the Arts

National Pride and Tax Compliance: A Laboratory Experiment Using a Physiological Marker

Working Paper No. 2021-07

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National Pride and Tax Compliance: A Laboratory Experiment Using a Physiological Marker

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Abstract

This paper reports on a laboratory experiment designed specifically to test the influence of national pride on tax honesty while using a physiological marker to observe emotional responses to patriotic priming. Participants were exposed to one of three framing videos before earning income in a real effort task, and at each of 20 rounds (years) were given the chance to declare their taxable income. We find that psychological priming through exposure to symbols of Australian national pride and national identity had a positive effect on the level of tax compliance among Australian but not non-Australians. In addition, non-Australians report lower tax compliance ratios in the treatment groups than in the control group which may indicate an outgroup effect. When exploring the potential of a physiological marker of national pride we observe two different types of physiological responses to the activation and effects of national pride and its impact on tax compliance among Australians. Iconic images activate the parasympathetic nervous system while sports scenes activate the sympathetic nervous system, but both types of images and responses are positively associated with tax compliance. In addition, we find that non-Australians resident in the country for more than a year report a higher level of tax compliance, and that there are some similarities in heart rate variability (HRV) responses between Australian citizens born in the country and those born overseas who have been in Australia for a longer period. Overall, the results support the proposition that identifying with an ingroup at a national level is important for tax compliance.

1 Introduction

The late (and great) Kenneth Boulding (1992, p. 93) stated that “the dynamics which govern the creation, destruction, and distribution of various forms of pride and shame in society are very little understood, yet nothing perhaps is more crucial to the understanding of the overall dynamics of a particular society than the marked differences which exist among societies in this regard”. As an important form of pride in societies across the world, the underlying dynamics of national pride suggest a particularly interesting topic of inquiry. The connection between ingroup identity and national pride raises questions about its potential to influence cooperation, and therefore what impact it might have on citizens’ willingness to pay taxes. Given that a well-organised tax regime is essential to the functioning of civilised society, an understanding of the overall dynamics between national pride and tax compliance is of special interest.

National pride can be defined as “the positive affect that the public feels towards their country as a result of their national identity. It is both the pride or sense of esteem that a person has for one’s nation and the pride or self-esteem that a person derives from one’s national identity” (Smith and Jarkko, 1998, p. 1). Of course, the idea that nationalistic propaganda is effective in prompting certain behavioural outcomes is not new; both modern and ancient history can testify to the results of overly-enthusiastic patriotic sentiment. In almost all countries, national pride is commonplace and employed as moral suasion across a range of contexts. Governments, businesses, and advertisers clearly believe that this sentiment is capable of changing economic decisions; actively appealing to the ideals of national pride and duty to secure solidarity and compliance among citizens. We know that governments all over the world expend significant resources in celebration of their national days, funding advertising campaigns, community fund-raisers, and fireworks¹. We constantly absorb advertising messages and socialisation through activities and lessons at school (Konrad and Qari, 2012). The compulsory singing of the national anthem at school has even been defended by some scholars. Dr Kevin Donnelly – a senior research

¹ Girling (2010, p. 180) points out that “American presidents, Democrats as well as Republicans, do as a matter of course. My fellow Americans. It harks to the founding principles of the Bill of Rights. To declare yourself American is to buy into an ideal. So it is to declare your yourself French: *liberté, égalité, fraternité*”.

fellow at the Australian Catholic University and past chair of a review of the Australian national curriculum – declared in an opinion piece published in the *Sydney Morning Herald* that “if Australia is to be a cohesive, open and prosperous society instead of one where disunity prevails, future citizens must be taught to acknowledge and celebrate our national institutions and what makes us unique”². Yet, it is reasonable to question the purpose behind creating and reinforcing this sense of belonging, pride, and celebration about being a citizen of a particular country. After all, nationality is a designation often based on the arbitrary geography of birth; it usually cannot in any way be characterised as a personal achievement; and could be regarded merely as a type of label. But daily exposure to national symbols (Butz, 2009), and exposure to the national discourse provides the context through which national pride is activated, and through which an individual might acquire an understanding of the characteristics of what is assumed to be a “good citizen”. For example, popular discourse regularly includes pronouncements on whether a behaviour is or is not ‘Australian’, ‘American’, or ‘British’, and so on. Both political rhetoric and commercial advertising appeal to national pride and patriotism in a range of situations, including the rationale behind pursuing a protectionist regime (Mayda and Rodrik, 2005); for encouraging the purchase of war bonds (Slemrod, 2007); for investing money in sporting events (see Van Hilvoorde et al., 2010, although the authors find no empirical evidence of the planned increase in national pride to support the political rhetoric); for advertising during sporting events (Kim et al., 2013); for defence spending; to market particular products as ‘Made in the USA’, or ‘Proudly Australian’, and for maintaining strong economic growth through interventions designed to benefit only the nation state (as noted by Clift and Woll 2012, p. 308, the term “economic patriotism” was coined by the French Prime Minister). Citizens are encouraged to consume for the good of the country (Mercer, 2009); to have children for the good of the country (Risse, 2010); and Newt Gingrich infamously claimed he loved his country so much it caused his infidelity to his wife (Hertzberg, 2011).

Given that such a phenomenon is so prevalent in society, it would seem important to understand the implications; yet, there is very little research available into the effect of being exposed to such symbols and messages in the context of compliance and cooperation. Slemrod

² <https://www.smh.com.au/opinion/tolerance-of-diversity-cannot-exist-without-common-values-20151027-gkja8z.html>

(2007) refers to the role of conscience in tax compliance, noting that “[a]ppeals to patriotism to induce citizens to pay their taxes (and, often, buy war bonds) are common in recent times” (p. 40). However, he also stresses concerns regarding the efficacy of suasion on tax compliance: “That such campaigns are successful during ordinary (non-war) times in swaying taxpayers from their otherwise optimal compliance strategy has not been compellingly demonstrated” (p. 40).

Previous empirical evidence has relied heavily on using survey data, finding support for the proposition that national pride is correlated with a higher willingness to pay taxes (Torgler, 2004; Torgler, 2005; Torgler, 2007; Konrad and Qari, 2012). Wenzel (2007) investigated three levels of taxpayers’ identity (at the personal, subgroup, and national level) and finds that an identity constructed at the national level is the most conducive for tax compliance, even going so far as to conclude that “the concept of identity is key to responsive regulation” (p. 31). Gangl et al. (2016) report results of one survey and three experiments that manipulate patriotism by displaying either a national flag, national landscapes, or by priming national achievements. The findings indicate that emphasising national achievements promotes patriotism and increases cooperation and trust in public institutions, while focusing on national achievements or national landscapes increases citizens’ identification and cooperation with their community. Therefore, in this study we narrow the focus to specifically test the potential influence of national pride on tax compliance. We do this by using an experimental setting with a psychological priming event, combined with recording of physiological data that indicate whether the participants were relaxed or excited by the psychological trigger. Previous studies have introduced physiological measurements in the context of tax compliance (Dulleck et al., 2016) or social dilemmas (Dulleck et al., 2014). Thus, we employ a standard tax compliance experiment (see Alm, 1999; Alm, 2019; Torgler, 2002; Alm and Malézieux, 2020), adding a psychological framing device designed to provoke a feeling of national pride to the protocol.

Both Australian citizens and foreign nationals were exposed to one of three videos: the first depicting typically Australian iconic images, the second comprising footage of sporting achievements, and the third being a control video with randomised patterns. We also recorded the heart rate variability of the participants during the psychological priming and during their tax payment decisions. The results indicate that Australian citizens who are affected by the national

pride priming exhibit a higher level of tax compliance (more likely to pay their taxes), and that there is also a difference in tax honesty between Australian and foreign participants. This is the novel result of the paper: we are able to control for the physiological effect of the national pride triggers, observing increased tax compliance in those who respond to the treatments. The rest of the paper is organised as follows: Section 2 explains the design of the experiment, while Section 3 presents the results and discussion. Section 4 concludes.

2 The experiment

2.1 Design of the experiment

The experiments were conducted over nine sessions at the Queensland Behavioural Economics Laboratory (henceforth referred to as QuBE), in a dedicated computer lab featuring partitions between the students to prevent copying or communication during the experiment. Adjoining the lab room (separated by a door) is a small office where the main terminal operated as the server from which the experiment was initiated and monitored. The experiments were carried out in line with the Queensland University of Technology (QUT) ethics requirements for research involving human participants, under the approval of QuBE. The participants all gave informed consent, signing forms after receiving information that it was an incentivised experiment and that physical measurements would be taken during the experiment. The experiments were conducted during July and August 2013 as this is one of the best times of the year for recruiting students, being the start of the second semester in the Australian academic year. Participants were recruited with ORSEE (Greiner, 2004) from QUT's standard participant pool for economic experiments.

From the subject group of 138 participants, 56 percent were male and 44 percent female. The sample comprised both international and domestic students, with 79 students not born in Australia and 59 students born in Australia. However, while 60 percent of students were born overseas, many have since become citizens, which indicates that they have been resident in the country for a considerable length of time. Of the foreign-born students who answered the question on whether they were a citizen or not, 28 percent were not, and 72 percent had become Australian

citizens. A dummy variable was constructed to measure the citizenship status of the participants (Australia dummy), where 1 = all participants born in Australia, as well as those born overseas who have since become citizens; and 0 = non-citizens. The addition of students not born in Australia but who have since become citizens changed the proportion to 57% Australian citizens and 43% non-citizens. It can be presumed that those in the Australian citizen group would have been subjected to similar socialisation processes at school (singing the Australian national anthem) and at home (attending national celebration days such as Australia Day) and would have observed the same pro-Australian messages in television advertisements, and would have listened to the same political rhetoric regarding what is ‘Australian’ and what is not. Students who had emigrated at a younger age would have been exposed to all of these factors since residing in Australia, and those emigrating more recently would have at least partial exposure to rhetoric and socialisation³. The subject pool had fully randomised assignment into control and treatment group. Each participant was randomly assigned into a group of around 16 students and that group was randomly assigned to an experimental session.

The experiment lasted just under one hour. Students earned on average \$19.33 in accumulated income (referred to as “wealth”) during the experiment, with a minimum earn of \$10.15 and maximum of \$29.19. All payments were made in Australian dollars (AUD). The experiment consisted of three stages: the first stage employed either a psychological trigger for national pride or a control. Heart rate variability monitors were employed to observe physiological changes and reactions to the framing stimulus. Since national pride is a psychological experience towards the national identity, it was important to observe any physiological changes produced when activating this emotion. It was also important to observe the differences in variance of physiological changes between the control group and the treatment group. The second stage was an incentivised tax compliance experiment. During the final stage, socio-demographic and associated information was gathered via a questionnaire administered after completion of the experiment, while students waited for their payment to be calculated and prepared. The participants answered questions relating to their citizenship status, feelings during the experiment, opinions about cheating on welfare, and other relevant topics (see Appendix, Figures A21-A31).

³ The process for categorising according to length of stay in Australia is discussed in section 3.4

The responses to the questionnaire were not forced, so some observations are missing from this section. The experiments were programmed and executed with CORAL (Schaffner, 2013)⁴, a lightweight and flexible framework for laboratory experiments.

2.2 Introduction stage

Participants were welcomed to the laboratory, their attendance was registered, and they received instructions on how to attach the heart rate monitors with three single-use electrodes which were placed on each participant's chest. Heart rate monitors were then individually checked by the experiment administrator to ensure they were functioning correctly.

Communication between participants was forbidden during the experiment, however questions to the experiment administrator were permitted. When participants started the experiment, they were met by the screen shown in the Appendix, Figure A1. Students were given a hand-out of the experiment instructions (provided in the Appendix, Figure A17), and instructions were also displayed on the computer screen (see Appendix, Figure A2). All instructions were presented in the same language (English), and a shorter set of instructions were read out by a native English speaker. This ensured that everyone received the same instructions, and gave participants the opportunity to clarify the instructions. It also ensured that everyone knew that all participants received the same instructions and the same information. Importantly, the main experimenters were the same across all sessions, which eliminated possible variations arising from uncontrolled procedural differences or uncontrolled personal differences between the experimenters.

The participants were informed that this was an experiment in the economics of decision making, and that they could earn real money by taking part in the experiment. They were also told that their decisions would affect the amount of money earned. Before beginning the income earning stage of the experiment, the participants went through a trial round to ensure they understood the instructions, particularly the income earning and tax payment task. During this trial round (see Appendix, Figure A3), the experimental taxpayers engaged in the same type of

⁴ CORAL was developed as a user friendly, adaptable, and stable alternative to Z-tree; across nine sessions it did not crash or result in unusable data.

problem-solving tasks repeated in the 20 rounds (years) of the income earning task.

The next step gave participants practice in declaring their income (see Appendix, Figure A4), before showing the results of their decisions (Appendix, Figure A5). After successfully completing the trial round, the experiment moved to a confirmation screen, at which point the participants were asked to check whether they understood the experiment and were happy to proceed with the next stage (Appendix, Figure A6).

2.3 Psychological Framing

To ensure that all students were exposed to the psychological framing at the same time, the experiment was programmed to wait for all students to register their understanding of the instructions. As some students completed the trial round faster than others, a wait screen was displayed to give the others a chance to progress to the same stage (see the screenshot in Appendix, Figure A7).

Once all students had indicated that they understood the instructions, the experimenter showed a short video as a method of introducing the psychological framing. There were three versions of the framing video, each of equal length. The first depicted “iconic” images of Australia, including Uluru, the Opera House, the Sydney Harbour Bridge, the national flag, the Outback, and the Great Barrier Reef. This video was set to an orchestral version of the national anthem “Advance Australia Fair”. The second version of the video was based on great and memorable Australian sporting moments primarily from the previous 10 years (but also including the record-breaking 4x100 metre men’s relay at the Sydney Olympics in 2000). This video was composed of clips such as the Socceroos qualifying for the World Cup in 2006, and then again in 2013, as well as Sam Stosur winning the US Grand Slam Tennis Championship. This “sport” video was set to the same instrumental version of the national anthem as the “icon” video. The third video was a control video, with a neutral themed Adagio by Mozart, set to the visualisations automatically provided by iTunes. An example of the type of random moving patterns encountered by the students in the control can be seen in the Appendix, Figure A8. The video was produced by pre-recording the visualisations on a desktop to ensure that each screening of the control video was exactly the same.

2.4 Real effort task/income earning stage

Once the video had finished, the students were informed that the experiment had begun, and were reminded again of the real effort task involved (Appendix, Figure A9). Participants were then presented with their first set of 10 problems to solve within the 20 second time frame, the result of which would determine their income for that round.

Students received a minimum payment of \$5 for participating in the experiment. This lump sum was distributed over the 20 rounds of the experiment and resulted in a tax adjusted 36 cent endowment per round. Students earned additional income by answering a series of simple 3 digit problems. Students were given 20 seconds to answer as many as possible. The introduction of an endogenous allocation of money based on their abilities could provide a stronger test of their compliance, as “earning” the money reinforces the idea of personal achievement and increases the costs of handing over the money. Requiring this effort in earning income further approximated reality as the students were making tax compliance decisions based on their income rather than perhaps treating it as an endowment with which they could gamble against the possibility of an audit (see Durham et al., 2014 for an overview of how different income sources affect tax compliance).

2.5 Income Declaration Task

Participants were then asked to declare their taxable income. Some participants raised questions regarding this step. In all cases the students were given the same answer: “It is tax time, and it is time to declare your income. It is your decision”. To the extent that it was possible, the experimenter did not deviate from this information.

The computer screen then displayed information advising the student of the outcome of that round, including how much tax they had paid. This same procedure repeated over the 20 rounds of the experiment, and the students were aware from the beginning of the experiment that there would be 20 rounds, or years, during which they would earn income and accumulate wealth.

Of course, full defection was possible, and participants could declare no income if they wanted to avoid paying taxes completely (Appendix, Figure A10).

If the participant chose full compliance, they declared their total income for the period

(Appendix, Figure A11 and A12). A variable called *tax compliance ratio* was generated that measured the ratio of the income declared by the participant to the income actually earned. Tax compliance ratio becomes the dependent variable in the following econometric analysis on the effect of the treatments and HRV.

Initially, an additional ‘treatment’ was included to test whether knowing the destination of the tax payments made a difference to tax compliance. The treatment alternated between two cases: in the first, students were explicitly told that taxes would be paid directly to the Australian Taxation Office (ATO). In the second, there was no mention of any destination for the taxes, and students were told only that the tax they paid on their earnings would be deducted from their accumulated wealth. After the first few sessions it became clear that it did not matter to the students whether the instructions were explicit about paying the tax or not (there was no effect on the final payments). However, the ATO treatment was retained as it added realism to the experimental setting, and also maintained social distance from the experimenter. In total, six sessions were conducted with the ATO treatment and three sessions without, and it seems that this aspect of the experiment is novel in the tax compliance literature. To comply with the ethics requirements of the QuBE lab and QUT generally (which prohibit experimenters from deceiving participants or telling them something that is not true during the course of the experiments), the taxes were actually paid to the ATO for the sessions in which students were advised of the destination for their tax payments (a money order for a total of \$469.61 was forwarded to the ATO after completion of the nine experiment sessions).

The likelihood of audit in each round was 10 percent. There was no endogenous audit selection rule; that is, every participant in each round was equally likely to be selected for an audit. If students were found to have cheated on their declared income, they were fined 1.5 times the amount of tax they owed in that round (year), which was deducted from the income earned for that round (see Appendix Figure A13 for screenshot of audit outcome).

2.6 Questionnaire

At the end of the 20 rounds, participants were asked to complete the questionnaire, after which they would be paid and could leave (see Appendix Figures A21-A31 for screenshots of

questions). The students were not forced to respond to all items on the questionnaire, which led to some missing data. While this is clearly not ideal, there is a trade-off between the decision to force responses to questions when dealing with the possibility of noisy data (Hartner-Tiefenthaler et al., 2013).

2.7 Physiological measurement

Established protocol from previous QuBE experiments was followed when measuring heart rate variability (HRV) (Dulleck et al., 2011; Dulleck et al., 2014; Dulleck et al., 2016). One advantage of using the HRV monitor to record physiological data is its portability, which overcomes one of the major disadvantages of fMRI technology – the size of the equipment. The nature of fMRI studies restricts the number of participants that can be involved in an experiment, as well as limiting the interactions between participants, where the experiment design calls for interaction (Dulleck et al., 2011). In contrast, small, portable HRV devices are non-intrusive and record HRV parameters with medical levels of accuracy on a large number of participants simultaneously (Dulleck et al., 2011; Torgler, 2019). As with previous experiments, (Dulleck et al., 2011; Dulleck et al., 2016; Dulleck et al., 2013) HRV was recorded using the Holter Medilog Digital ECG Recorder AR4. These HRV monitors have a high sampling rate of 128Hz. The devices also measure respiration rates, and have an inbuilt algorithm for detection of heartbeat.

The HRV can offer some insight into the processes carried out by the vagal nerve, which itself offers bidirectional feedback between the brain and the visceral organs, impacting the autonomous nervous system (ANS). The ANS is made up of the inhibitory parasympathetic nervous system (PNS) and the excitatory sympathetic nervous system (SNS), the operations of which can be measured via variability in the heart rate (HRV) (Appelhans and Luecken, 2006, Falk et al., 2011). The ANS has two major yet physically conflicting purposes: it monitors and takes care of the internal organs, and also responds to “external challenges” (Porges, 2011, p. 80). The SNS is dominant during physical or psychological stress (Appelhans and Luecken, 2006), and “affects the heart rate indirectly through the sympathetic nerves” (Dulleck et al., 2011, p. 119). In contrast, the PNS is generally dominant during resting, relaxing, digesting, and social engagement behaviours, promoting growth and restoration (Porges, 2011, p. 80). The PNS affects the heart

directly through the vagal nerve. Porges (2007a, p. 302) suggests that HRV “may provide a portal to the dynamic assessment of vagal function”, and further, that “beat-to-beat heart rate variability is a window to the neural regulation of the heart”. However, Porges notes that the ability to reach any conclusions regarding HRV and its emotional correlates relies on the ability to accurately measure, quantify, and interpret HRV, as well as knowledge of the underlying neural mechanisms (Porges, 2007b).

This study is specifically interested in measurements of the frequency of HRV (explained in Appelhans and Luecken (2006)). “Research has also shown that in controlled environments, the ANS’s control over HRV can be used to identify individual stress levels (LF/HF ratio)” (Dulleck et al., 2011, p. 122). The SNS is related to the LF (low frequency, [0.033-0.15 Hz]) and PNS is related to the HF (high frequency, [0.15-0.4 Hz]), and to respiratory sinus arrhythmia (Appelhans and Luecken, 2006, p. 233). As explained by Dulleck et al. (2011) and Appelhans and Luecken (2006), the ratio of LF to HF activity may serve as an indicator of psychological state; representing the relative dominance of SNS to PNS in the control of the heart. We anticipate that with measurement of HRV, we gain an insight into the activities of the nervous system, and may even be able to pinpoint the physiological correlates of emotions.

A standard time-frequency analysis approach is followed to obtain the LF/HF ratio from the interpolated heart-beat data (Dulleck et al., 2011; Appelhans and Luecken, 2006). We report results using the Autoregressive method (AR), but the results remain stable over different methods (FFT, AR and Wavelet transform).

3 Results

In this section, we describe the effect of the psychological framing treatments (exposed to *icon* and *sports* video) on participants’ decisions in the tax experiment, namely, the *tax compliance ratio*. When comparing the *tax compliance ratio* across groups, we perform mean comparison test with *p*-values adjusting for multiple comparison using the Tukey's method, which conservatively accounts for the elevated type I family-wise error rate. Since the outcome variable of interest is bounded between 0 (non-compliance) and 1 (full-compliance), we also perform the Wilcoxon–Mann–Whitney rank sum test with multiple comparisons adjustment following the Dunn’s test

procedure. While we report only the results from the mean comparison tests, the results from the nonparametric tests yields very similar qualitative conclusions.

3.1 Effect of trigger and nationality on tax honesty

Before exploring nationality differences, we checked the general effect of the different treatments on the average tax compliance ratio (see Figure A14 in the Appendix). Overall, there is a positive effect of the icon treatment on tax honesty in the pooled sample. That is, participants in the treatment using iconic images to trigger national pride demonstrated a higher level of compliance (Mean = 0.74; 95% CI: 0.71–0.77) relative to those in the control, with a 9.6 percentage points difference ($p < 0.001$). Surprisingly, those in the sport treatment (M = 0.60; 95% CI: 0.57–0.64) reported a relatively lower level (4 percentage points) of tax compliance than those in the control, however this effect was not statistically significant ($p = 0.14$). The average tax compliance ratio for the control treatment was 64.3% (95% CI: 61.8–66.7%).

To determine whether *Australian citizens* display a stronger reaction to the treatments than *non-Australians*, in Figure 1a we report and compare the means of *tax compliance ratio* distinguishing the sample between treatments and citizenship status. We observe that *Australian citizens* in both the *icon* and *sport* treatments designed to trigger national pride reported higher levels of tax compliance than non-citizens in the respective treatment groups. Specifically, *Australians* reported 22.1 (95% CI: 0.14–0.30; $p < 0.001$) and 17.2 (95% CI: 0.06–0.28; $p < 0.001$) percentage points higher tax honesty than *non-Australians* in the *icon* and *sport* treatment, respectively. This substantial contrast is highlighted by the statistically insignificant difference in the level of *tax compliance* between *Australians* and *non-Australians* in the control group (difference of 3.9 pp, 95% CI: -0.11–0.03; $p = 0.59$). We also find that the *tax compliance ratio* of *Australians* in the *icon* treatment is, on average, 19.4 (95% CI: 0.12–0.27; $p < 0.001$) percentage points higher compared to *Australians* in the control group, whilst *non-Australians* exposed to the *icon* treatment show lower levels of *tax compliance* to their counterpart in the control group, although the difference is not statistically significant (difference of -6.57 pp; 95% CI: -0.15–0.015; $p = 0.19$). Although we did not find a significant effect on *Australians* who were exposed to the *sports* video (average difference in compliance ratio compared to *Australians* in the control group

is 2.76 pp; 95% CI: -0.05–0.105; $p = 0.911$), *non-Australians* reported a considerably lower level of compliance in the *sport* treatment compared to their peers in the control group (difference of -18.4 pp; 95%CI: -0.29– -0.08; $p < 0.001$). *Non-Australians* may experience the *sport* treatment as an adversarial situation due to its competitive nature in which they find themselves in the outgroup⁵. It is therefore not surprising that they do not want to cooperate with the group to which they do not belong.

In Figure 1b we distinguish between *Australian* participants who were born in Australia ($n = 58$) and those born elsewhere ($n = 21$). We find that the *icon* treatment has a similar effect on Australians who were born in the country as they report a higher level of *tax compliance* than those in the control group (difference of 17.9 pp; $p < 0.001$). Interestingly, locally born *Australians* also demonstrate a higher level of tax honesty in the *sport* treatment compared to their counterparts in the control group (difference of 10 pp; $p = 0.024$). Furthermore, while *Australians* in the control group reported similar levels of tax compliance regardless of their country of birth ($p = 0.276$), those who were born outside of Australia reported higher level of tax compliance in the *icon* treatment (difference of 32.8 pp; $p < 0.001$) but lower level in the *sport* treatment (difference of -14.7 pp; $p = 0.032$) compared to the those in the baseline. However, due to the small number of observations among Australian participants born elsewhere, one should exercise caution when interpreting these results.

We also ran a set of ordinary least squares regressions to assess the robustness of our findings, taking into consideration effects from individual heterogeneity, namely, participants' age, gender, church attendance (dummy variable), field of study (*Business* dummy), degree (*post graduate* dummy), and disposable income. We further control for features in the tax experiment, i.e., round fixed effects, whether the participant was audited or fined in the previous round. We present the coefficient estimates of the treatment effects and the interaction terms between the treatment variable (*icon* and *sport*) and citizenship status of the full sample (Figure 2a) and country of birth (born in Australia) with the *Australian* sample (Figure 2b). It is evident that the coefficients of interest are quite stable to the addition of control variables and the effect size is comparable to the simple mean comparison tests.

⁵ We thank Dr Larissa Conradt at Max Planck Institute in Berlin for this insight.

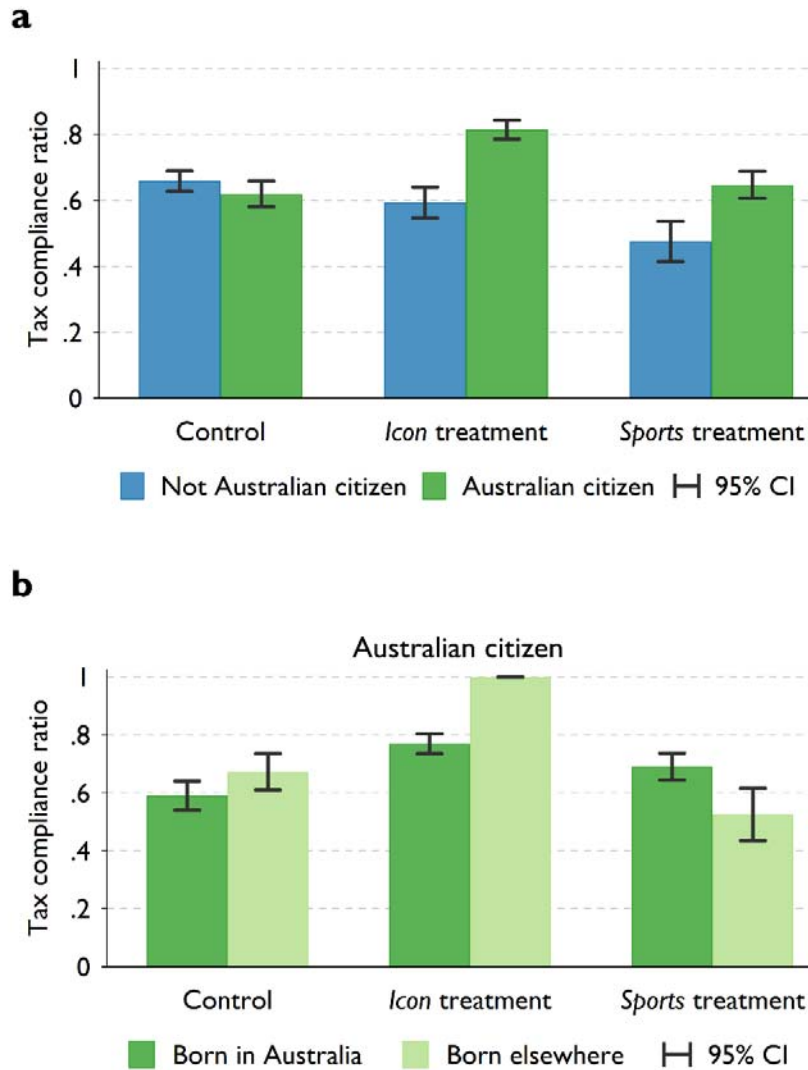


Figure 1: Tax compliance by treatment and citizenship status

Note: Panel **a** shows the average *tax compliance ratio* for participants in the control, *icon* and *sport* treatment group, decomposed by participants' citizenship status. Number of participants: $N_{control,non-Aus}=35$; $N_{control,Aus}=25$; $N_{icon,non-Aus}=16$; $N_{icon,Aus}=31$; $N_{sports,non-Aus}=8$; $N_{sports,Aus}=23$. Panel **b** shows the average *tax compliance ratio* of *Australians* participants decomposed by country of birth, i.e., born in Australia and born elsewhere. Error bars represent 95% confidence intervals. Number of participants: $N_{control,Aus\ born}=16$; $N_{control,born\ elsewhere}=9$; $N_{icon,Aus\ born}=25$; $N_{icon,born\ elsewhere}=6$; $N_{sports,Aus\ born}=17$; $N_{sports,born\ elsewhere}=8$.

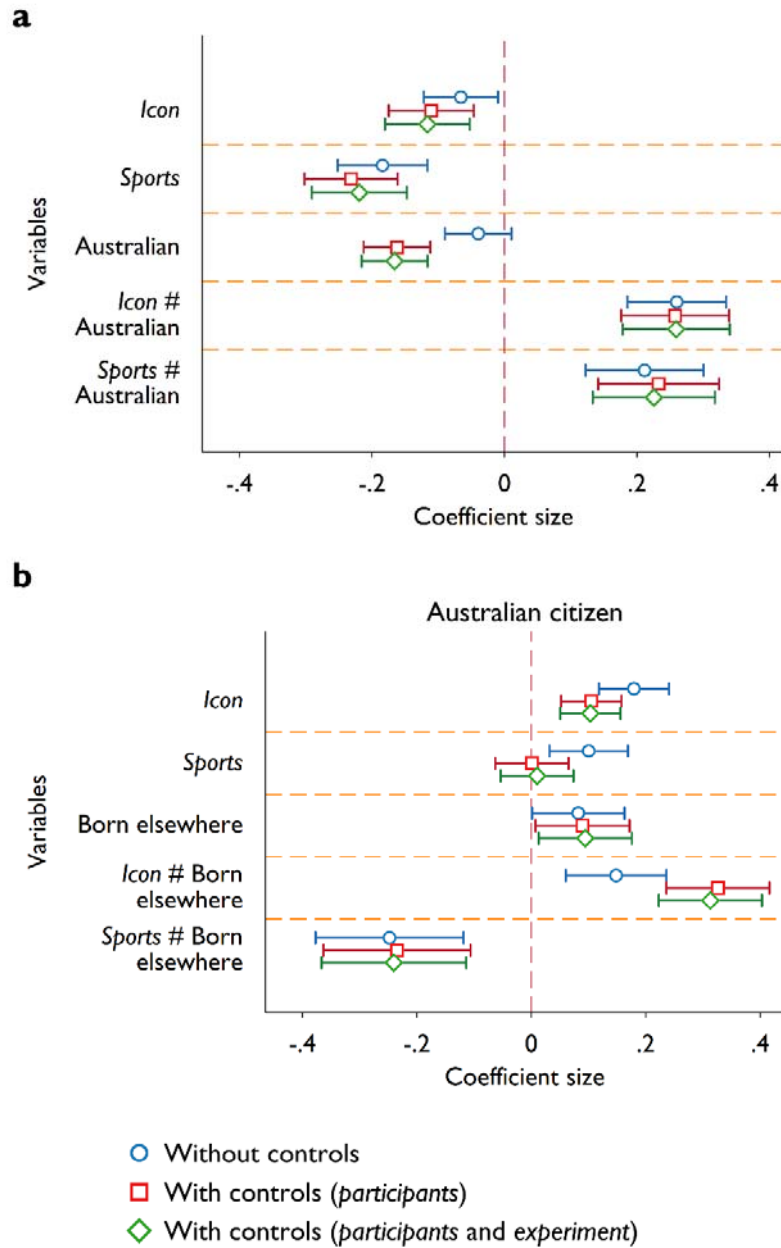


Figure 2: Effect of video framing on tax compliance

Note: Panel **a** shows the ordinary least squares (OLS) regression coefficients of the interaction terms between the treatment variable (*icon* and *sport*) and citizenship status (*Australian*) on participants' *tax compliance ratio*. In panel **b**, using the *Australian* sample, we show the coefficients of the interaction terms between the treatment variable and a dummy variable which indicates if the participant was not born in Australia. Blue circles represent the point estimates of the unconditional regressions without controlling for other factors. Red squares show the point estimates from regressions that control for participant's age,

gender (*female* dummy), church attendance, field of study (*Business* dummy), degree (*post graduate* dummy), and disposable income. We further control for experimental features such as round fixed effects, whether the participant was audited or fined in the last round (green diamonds). Error bars represent 95% confidence intervals based on robust standard errors.

3.2 Interaction of HRV with trigger and nationality

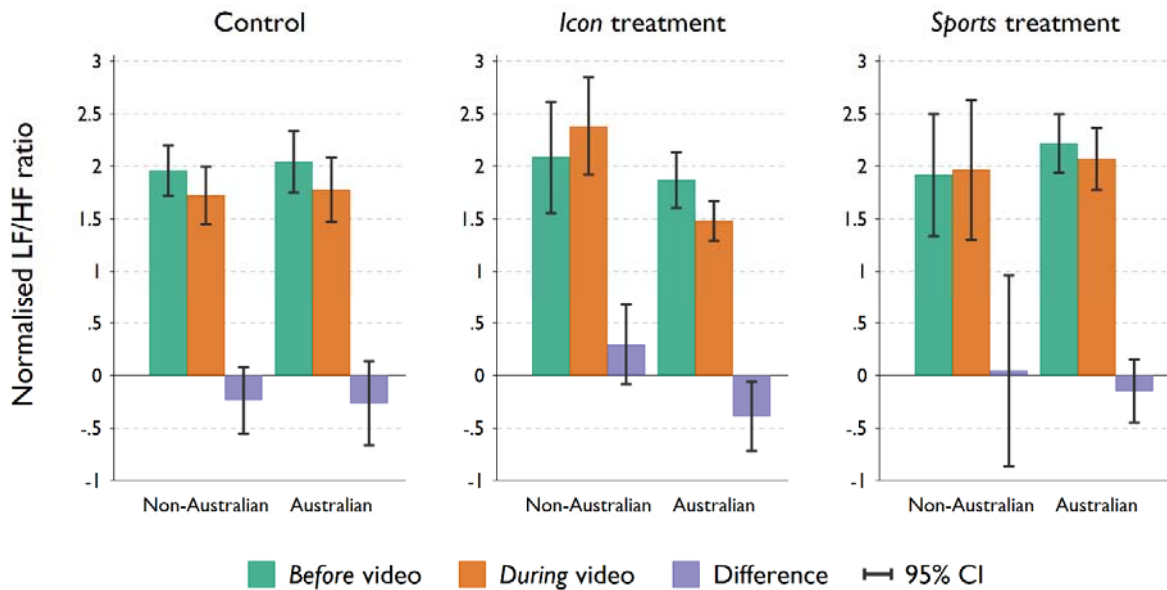


Figure 3: HRV and change in HRV before and during the video triggers (by citizenship status)

Note: Comparison of the average normalised LF/HF ratio (stress indicator) before and during the video framing to determine how participants react to the trigger/treatment. The green bars indicate the average LF/HF ratio before the video, the orange bars indicate the LF/HF ratio during the video, and the purple bars indicate the difference. A negative difference in the purple bars indicates that the LF/HF ratio decreased, due to a relative change in the PNS/SNS ratio, which indicates that participants were relaxed by the treatment. Error bars represent 95% confidence intervals.

The results presented thus far have yet to consider participants' physiological responses; namely, how participants' heart rate variability changes while watching the framing video. Hence, in Figure 3 we compare the normalised LF/HF ratio (stress indicator) *before* and *during* the video to determine how participants react to the trigger/treatment⁶. The green bars indicate the average

⁶ LF/HF ratio *during* and *before* the video were calculated by averaging the 1-second interval LF/HF readings across a period of 160 seconds during the video and 20 seconds before the start of the framing video, respectively. These ratios (and their difference) are normalised by the standard deviation of the 1-second interval LF/HF ratio in the *before*

normalised LF/HF ratio before the video, the orange bars indicate the average normalised LF/HF ratio during the video, and the purple bars indicate the difference of the two. A negative difference in the purple bars indicates that the LF/HF ratio decreased during the video, due to a relative change in the PNS/SNS ratio, which indicates that participants were relaxed by the treatment.

The control treatment relaxed both *Australians* and *Non-Australians* similarly (two-tailed *t*-test on the change in LF/HF ratio between the two samples: $p = 0.906$). On average, participants in the control treatment experienced a decrease in the normalised LF/HF ratio in response to the video (two-tailed *t*-test with pooled sample; $p = 0.043$)⁷. It suggests an increase in the HF activity and activation of the parasympathetic nervous system (PNS). Such a result is not surprising, and is supported by other studies on the relaxing effect of music in general (Uğraş et al., 2018).

In the treatment designed to trigger national pride through the use of iconic images (*icon*), only the *Australians* experienced a statistically significant decrease in the LF/HF ratio ($p = 0.023$)⁸. The *non-Australians* actually experienced the opposite reaction; although, this difference is not statistically significant ($p = 0.114$). Nevertheless, the difference in change of LF/HF ratio between the two samples is statistically significant (two samples two-tailed *t*-test: $p = 0.012$). Interestingly, the *Australians* exposed to the national pride trigger of *sports* experienced (on average) a slight decrease in the LF/HF ratio, indicating that they were slightly relaxed by the video; however, the difference is not statistically significant ($p = 0.317$). Lastly, we do not find any statistically significant difference in LF/HF ratio for *non-Australians* in the *sport* treatment ($p = 0.906$), nor is the difference statistically significant from other *Australians* in the same treatment ($p = 0.56$).

Furthermore, using self-reported levels of national pride, we examine whether the

video period. The distribution of (SD) normalised 1-second interval LF/HF ratio is slightly right skewed. Hence summarising the LF/HF ratios (and the differences) using average might be sensitive to spikes in the data. We thus report the median normalised LF/HF ratios before and during the video and the corresponding change (Figure A15 in the Appendix). The results are very similar to that of Figure 3.

⁷ We also perform the binomial probability test to assess whether the proportions of participants with increased or decreased HRV are different to 0.5 (which would suggest equal number of participants were excited or relaxed by the treatment video). The results are qualitatively the same as the one-sample *t*-test. Nevertheless, when the two samples were tested individually, neither is statistically significant (p -value equals to 0.183 and 0.137 for *Australians* and *non-Australians* in the control group, respectively).

⁸ Statistical significance is obtained for a *one-sided* binomial probability test ($p = 0.06$) on the proportion of *Australians* with decreased LF/HF ratio (66%).

physiological responses from the treatment triggers are more pronounced for *Australians* who have a higher level of national pride. To this end, we examine the coefficients of the interaction terms between treatment groups and self-reported national pride (5-point Likert-scale) in a regression on the changes in the LF/HF ratio, using only the *Australian* sample ($n = 68$). We find that the relationship between the average changes in the LF/HF ratio – relative to the *control* group – is more positively associated with self-reported national pride in both *icon* ($b = 0.317, p = 0.063$) and *sport* ($b = 0.622, p = 0.009$) treatment groups. This suggests that *Australians* with higher national pride are less relaxed/more excited when exposed to the triggers and compared to those in the control group.

3.3 HRV responses to trigger, nationality, and tax honesty

To separate participants into those that showed a strong physiological reaction and those that did not, treatment specific cut-offs were introduced. The analysis of the changes in the LF/HF ratio (Section 3.2) made it clear that a single cut-off could not be chosen globally due the large heterogeneity of subjects' reactions to the different treatments. Hence a suitable cut-off was selected based on a visual inspection of the relationship between the HRV data and the tax declaration behaviour of the participants in the experiment with the intent to maximise the differences between affected and not-affected participant groups.

In Figure 4, we show the difference in the levels of tax compliance according to whether the participants are *Australian* or *non-Australian*, and also whether they were excited or relaxed by exposure to the treatment; i.e., changes in the LF/HF ratio that were above or below the treatment specific cut-offs. It is clear that both *Australians* and *non-Australians* whose change in the LF/HF ratio were below the control treatment cut-off (relaxed) demonstrated higher *tax compliance* (left panel). Perhaps it is not surprising that some participants were relaxed by a neutral video set to a piece by Mozart, although there are mixed results from studies that attempt to prove or disprove the so-called “Mozart effect” (see Burns et al., 1999 and Chabris, 1999 for a discussion on the differing perspectives). Nevertheless, it is intriguing that our participants who were relaxed by the control video exhibited a higher tax compliance than the participants who were not relaxed by the same video.

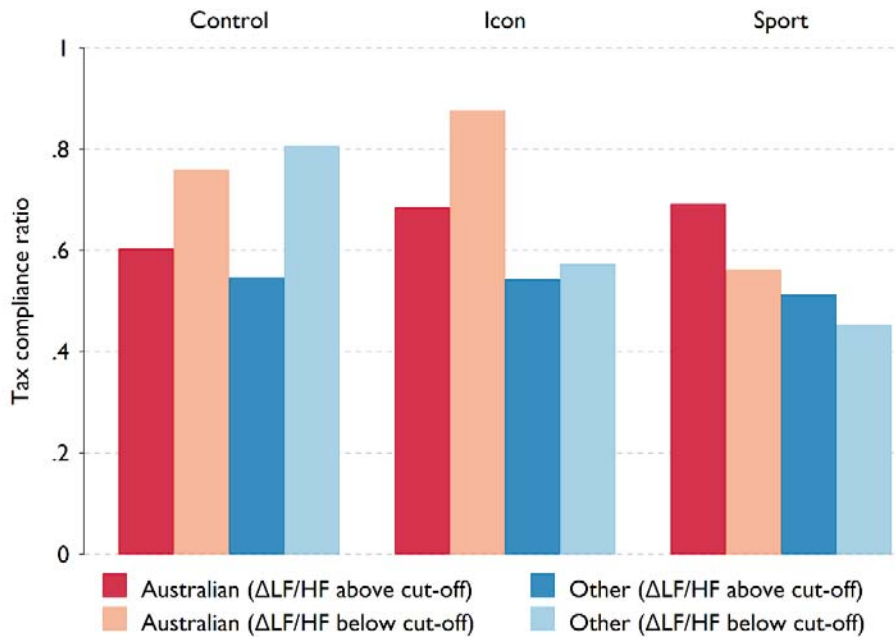


Figure 4: Tax compliance by treatment, citizenship status, and HRV

Note: The red bars indicate the tax compliance ratios of Australians who experienced a relative increase (darker shades) in the LF/HF ratio above the treatment specific cut-off and who demonstrated a relative decrease (lighter shades) in the LF/HF ratio (below the cut-off), respectively. The blue bars are tax compliance ratios of the non-Australians who were excited (darker shades, Δ LF/HF above treatment specific cut-off) and relaxed (lighter shades, Δ LF/HF below cut-off) by the video.

We also see that Australians for whom the Δ LF/HF ratio fell below the icon treatment cut-off (relaxed) demonstrated a higher level of tax compliance (light red bar) with a difference of 19.1 percentage points, compared to Australians who exhibited a relative increase in LF/HF ratio in the same group, as well as Australians in the control group (difference of 27.3 pp, and 11.6 pp compared to those with increased and decreased LF/HF ratio, respectively).

This effect is important, because while participants who were relaxed in the control group showed higher tax compliance irrespective of citizenship, in the icon treatment only Australians that were relaxed showed higher tax compliance. On the other hand, the Australians with Δ LF/HF ratio above the sports treatment cut-off (indicating an activated SNS) also demonstrated high levels of tax compliance (mean = 0.69). This group is denoted by the darker red bar in the right panel of

Figure 4, indicating Australians whose LF/HF ratio increased above the cut-off in response to the sport video. This effect is also important as it shows a large contrast to the patterns observed among participants in the control group. Additionally, Australians with Δ LF/HF ratio below the cut-off in the sport treatment showed lower tax honesty (lighter red bar) compared to their peers who were relaxed in the control group (difference of 19.8 pp). Such results might be understandable from an ingroup/outgroup or even an evolutionary or biological perspective. Australians have been socialised through exposure to these iconic landscape images, and when presented with this video set to the national anthem, are able to recognise the images and music as belonging to their ingroup. They are part of the group this video represents, and thus their neuroception in orienting to this environment would assess that the environment is familiar, and safe (see discussion of Porges (2011)). Activating their PNS and allowing relaxation – and promoting social engagement behaviours – could account for the increased tax honesty or tax compliance. Non-Australians are not part of this ingroup so do not feel the same sense of familiarity or socialised prompt to contribute to the group. Furthermore, the sport treatment activated the SNS in Australians, with the neuroception assessing a challenging situation (competition with the outgroup), regardless of the fact that Australia was winning in all scenarios presented (enhancement of cooperation through ingroup feeling). The physiological response was still one of reaction to a challenge, with increased SNS activity. Australians who were excited by the video exhibited higher tax compliance/tax honesty, suggesting there are at least two different channels through which national pride and national identity may be activated to invoke the ingroup belonging and encourage increased tax compliance. That is, for members of the ingroup, increased tax compliance is correlated with increased PNS activity, and increased tax compliance is also correlated with increased SNS activity. The results of this study have found not only one possible physiological marker of national pride, but potentially have identified two such markers.

3.4 Socialisation

Next, we explore the effect of the treatments on participants in the *non-Australians* group. The response might be mediated by socialisation, as measured by the duration of time in Australia⁹.

⁹ The level of socialisation and integration may naturally differ from person to person.

We thus categorise *non-Australians* participants into two groups based on their length of stay in Australia, namely, *less than or equal to one year* ($n = 34$) and *more than one year* ($n = 25$). In Figure 5a, we show the effect of the framing videos on *tax compliance* of *non-Australian* participants, grouped by the length of socialisation. Figure 5b further breaks the samples into those with changes in the LF/HF ratio above or below the treatment specific cut-offs while exposed to the framing video¹⁰.

In general, *non-Australians* who stayed for more than a year (control group) report a higher level of tax compliance (regardless of whether they were excited or relaxed). This could be linked to a higher level of social integration. The *sport* treatment does not seem to lead to a strong crowding out effect for those who have been in Australia for more than 1 year. It is less clear why a prolonged stay in Australia would negatively affect compliance in the *icon* setting. When looking at the HRV, we observe some similarities between Australians and those born overseas who have been in Australia for a longer period. Excitement in the *sport* setting promotes *tax compliance*. However, contrary to *Australians*, a relaxing effect of the *icon* treatment is not correlated with higher levels of honesty.

¹⁰ Due to the small sample size, one should exercise caution when interpreting statistically significant estimates.

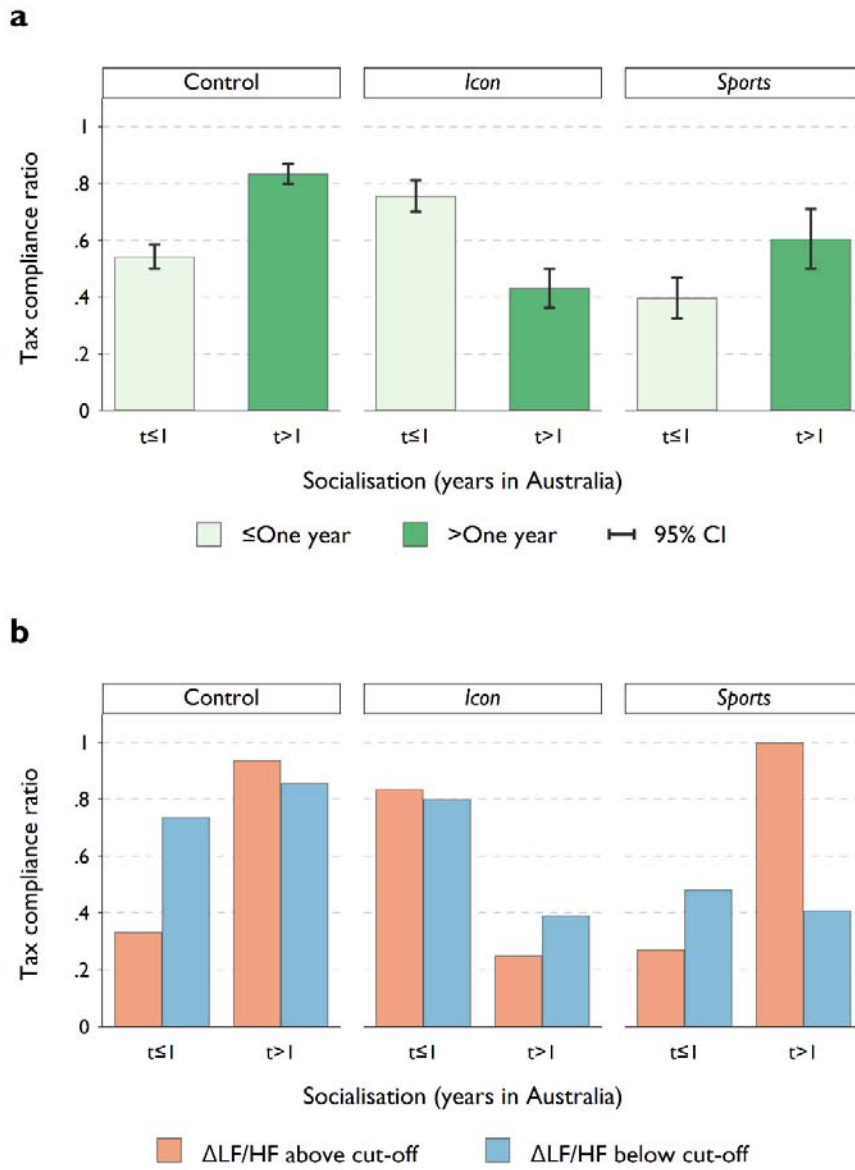


Figure 5: Tax compliance by treatment, duration of stay in Australia, and HRV
Note: Panel **a** shows the average *tax compliance ratio* of *non-Australian* participants by their length of stay (over one year or less) in each treatment group. Error bars represent 95% confidence intervals. In panel **b**, we further separate the sample into two groups by their physiological reaction to the framing video (Δ LF/HF ratio above or below cut-offs).

4 Conclusions

Tax compliance is an interesting topic as it fundamentally affects the ability of a government to collect the revenue necessary to provide the services and infrastructure we require in a “civilized society”. From this perspective, the willingness to pay taxes is of crucial importance to policymakers; identification of factors that increase compliance is the topic of a thriving research agenda. Based on the analysis conducted in this paper, it seems possible that certain methods of socialisation might engender a feeling of national pride (identified by measurable physiological processes), thereby increasing the level of tax compliance in some citizen taxpayers. However, not all citizens react in the same way to the same treatment, so national pride could be important for taxation only if people subscribe to the concept. Using psychological framing and measuring heart rate variability, we found evidence of a link between activated national pride and tax compliance, which is a valuable follow up from the survey results available in previous literature. One of the innovations of this paper is its use of heart rate variability (HRV) measurement in a standard tax compliance experiment in order to explore national pride and as a way of obtaining an external visualisation of national pride.

The results of this study indicate that both Australians and non-Australians who were relaxed by the control video (Mozart and iTunes visualisations) exhibited higher tax compliance. Australians demonstrated higher tax compliance when they were relaxed by national icon images and the national anthem (low LF/HF ratio), experiencing a PNS dominant reaction to the psychological framing. Familiar faces or voices can encourage a neuroception or orienting evaluation of a safe environment. It is also possible that familiar music and images could promote this neuroception of safety, due to priming from the national anthem included in the experiment videos. Australians also reported higher levels of tax compliance when they were excited by images of sporting victories set to the national anthem (high LF/HF ratio), which suggests two different pathways for the expression or activation of national pride. It also suggests that the results are not due only to the propensity of more easily relaxed individuals to be more compliant.

Initially, we were looking for a physiological marker of the emotion of national pride, but we now have evidence of two channels through which national pride affects the individual and their emotions. That is, there are two different sets of physiological measurements or patterns of

responses that could be correlated with the psychological phenomenon of national pride. Obtaining these types of measurements may eventually serve the same purpose as the established correlation between increased heart rate, release of cortisol, and anxiety. In future, if a person experiences certain externally measured physiological responses, there might be a clearer idea regarding the internal processes. In doing so, the link between emotions and actions (or possibly even motive and behaviour) is able to be glimpsed, by observing the neurophysiological correlates of attitudes or emotions using data obtained from devices such as heart rate monitors. As Porges (2011, p. 76) notes: "...whether we are talking about feelings, emotions, states, or moods, we are always attempting to describe the internal states that are continuously being monitored and regulated by the nervous system". As these internal states change, as they are monitored and regulated by the nervous system, they produce physiological markers that can be measured externally.

This paper has suggested that identifying with an ingroup at the national level is important for tax compliance, an observation that is in line with the assessment that "[t]axpayers' identities affect their commitments and solidarities, their endorsement of certain values and goals, their internalization of social norms, and their emotions and motivations" (Wenzel, 2007, p. 31). The HRV data is analysed with respect to the observed tax compliance behaviour, which is an important innovation, as it permits investigation of the links between identity, emotions, attitudes, morale, and tax compliance. It may be that these links and factors ask for different policy responses than do the rational utility maximising or economics of crime frameworks. On this topic, Wenzel (2007, p. 45) draws direct implications for the tax authorities: "... social identity, specifically a sense of inclusion, can provide considerable leverage for compliance ... regulators should be aware that whatever regulatory actions they take these could have negative side effects on people's sense of identity and thus undermine compliance levels. Taxpayers who are found to define themselves primarily in inclusive terms ... are more likely to feel commitment to the tax system (see Braithwaite, 2017). Regulators should nurture and harness this commitment through cooperative and educational approaches".

However, increasing tax compliance is not as simple as increasing taxpayer exposure to images or psychological priming devices such as the video treatments employed in this study. The collective social memory of the downside of excessive nationalism may have faded in the past few

decades, and recent political movements indicate the extent to which we have forgotten the risks. Although the dangers inherent in government sponsored nationalistic displays were not taken seriously, Wenzel (2007, p. 46) was optimistic that cynical manipulation of the inclusive identity would quickly be seen as an “insincere means of control, and this, as with other forms of coercion, will likely be attributed to an outgroup” (Taylor and McGarty, 2001 cited in Wenzel, 2007).

There are several promising directions for future research in this area. Firstly, further repetitions of the experiment would increase N and possibly allow for a robust clustering over the individual. It would also be interesting to adapt the experiment for testing in different countries as each nation has a slightly different way of expressing national pride (keeping in mind that “consequences of flag exposure are not unidirectional in all countries but rather depend on the social context and the concepts people associate with the flag and other national symbols” (Becker, et al., 2012, p. 5). In addition, having more observations would allow a more robust insights on the relevance of the socialisation process through analysing different people who have been in Australia for differing lengths of time would

We also found that non-Australians residing longer in Australia report a higher level of tax compliance (regardless of whether they were excited or relaxed). In addition, when looking at the HRV, we observe some similarities between Australians and those born overseas who have been in Australia for a longer period. Further research would generate more observations, allowing more robust insights into the relevance of the socialisation process by analysing different groups who have been in Australia for varying lengths of time. Moreover, it would be interesting to follow up on those insights with a longitudinal approach – tracking individuals before and after they become Australian citizens to determine whether there is any measurable difference in their tax compliance behaviour or in-group identification. This approach could also identify whether age is an important mediating factor on the effect of group identification and socialisation. In addition, a more detailed analysis could contribute to an understanding of how individuals acquire the rules and shortcuts for use in certain contexts (e.g., be a good citizen in the national pride context).

Other future directions for research could include the use of a more representative cross-section of the taxpaying public, as a cross-check on the validity of the results. Furthermore, analysing the difference between people who construct their identity at the state, regional, local,

or family level in a way that is stronger than the national identity would lead to valuable insights, as would an experiment in an area with a strong separatist movement. In addition, it would be interesting to test whether the relationship holds over time, or whether the effect of the national pride psychological framing is immediate (this would require participants to wear the HRV monitors for longer periods). The investigations listed above would also be valuable in different countries with strong regional identities and independence movements, for example, in Canada, Scotland, Spain, etc. Previous research has already provided evidence from Spain, Switzerland, and Belgium indicating that cultural and regional differences within a country affect tax morale (Torgler and Schneider, 2007). In sum, this is likely to be a rich field of research endeavour for some time.

Online Appendix

Figure A1: Introduction

Introduction

Thank you for participating in this experiment. The purpose of this experiment is to study how people make decisions. If you have any questions at any time, please raise your hand. Please do not speak to other participants during the experiment and please turn off your mobile phone now. We also ask you not to reveal any details about the experiment after you have participated.

You will receive \$5 for arriving on time. Depending on your decisions during the experiment, you will receive an additional amount. At the end of the experiment, you can privately collect the final amount in cash in a sealed envelope from the Economics and Finance from office (in room Z604).

Please enter your 5-digit participant number here:

Please enter your 3 or 4-digit device number here:

[Continue](#)

Note: Screenshot of introduction screen.

Figure A2: Instructions

This is an experiment in the economics of tax declaration. The experiment will consist of 20 rounds. Each round represents one year and proceeds in three stages.

First Stage: Earn your income

In the first stage of each year you will be given a fixed sum of 36 cents. This is your tax-adjusted show up fee of \$5 spread over the 20 years of the experiment. You will earn additional income by solving up to 10 'sum of digit' problems. The sum of digit problem requires that you sum up the individual digits of a 3-digit number, e.g. for the problem 123 the solution would be $6 = 1+2+3$. You will receive 12 cents for each correct solution you enter. You will have 20 seconds to answer as many as possible.

Second Stage: Declare your income

In the second stage you will then be asked to declare your income. All the information to make an informed decision will be provided on the screen.

Third Stage: Tax calculation and audit

In the third and last stage each year, the taxes payable on your declared income will be deducted from your income. Your net income accumulates as 'wealth'. In this stage, there is also a 10 % chance that you will be selected for audit, and your declared income will be checked against your real income in this year. If there is a discrepancy between your stated and your real income, a fine of 1.5 times the amount of tax you owe will be deducted from your income this year.

Please note that all taxes and fines collected during this experiment will be paid directly to the Australian Tax Office (ATO).

Trial round

On the next two screens you will go through an example of one year, to familiarise yourself with the screens. If you have any questions, please raise your hand.

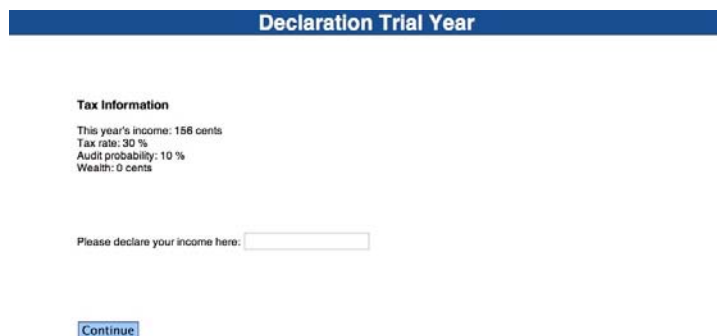
Note: Screenshot of instruction screen.

Figure A3: Earn income trial



Note: Screenshot of earn income trial screen.

Figure A4: Declaration



Note: Screenshot of trial declaration screen

Figure A5: Outcome of trial

Outcome Trial Year

Tax Information

This year's income: 156 cents
Tax rate: 30 %
Audit probability: 10 %

Wealth from last year: 0 cents
Income this year: 156 cents
Declared income this year: 156 cents
Tax amount paid this year: 47 cents
Wealth after this year: 0 cents

[Continue](#)

Note: Screenshot of outcome screen.

Figure A6: Understand instructions

Information

Once you confirmed that you understood the task ahead, you will watch a short video then the experiment will start.

Did you read the instructions and do you understand what you are required to do?

Yes

No

[Continue](#)

Note: Screenshot of understand instructions screen.

Figure A7: Waiting for video to start

Video

Please watch the video and wait for the experiment to continue.

Note: Screenshot of waiting screen before video started.

Figure A8: random visualisation during control video



Note: Screenshot of visualisation generated by iTunes.

Figure A9: Post-video information

Information

Next the experiment will start. Note that the next screen will be the first set of sum of digits problems and it will be timed for 20 seconds, solve as many as you can.

[Continue](#)

Note: Screenshot of post-video information screen.

Figure A10: Outcome of full defection in year 1

Outcome Year 1

Tax Information
This year's income: 108 cents
Tax rate: 30 %
Audit probability: 10 %

Wealth from last year: 0 cents
Income this year: 108 cents
Declared income this year: 0 cents
Tax amount paid this year: 0 cents
Wealth after this year: 108 cents

[Continue](#)

Note: Screenshot of full defection screen.

Figure A11: Declaration in year 2

Declaration Year 2

Tax Information
This year's income: 120 cents
Tax rate: 30 %
Audit probability: 10 %
Wealth: 108 cents

Please declare your income here:

[Continue](#)

Note: Screenshot of declaration screen.

Figure A12: Outcome of full compliance in year 2

Outcome Year 2

Tax information

This year's income: 120 cents
Tax rate: 30 %
Audit probability: 10 %

Wealth from last year: 108 cents
Income this year: 120 cents
Declared income this year: 120 cents
Tax amount paid this year: 36 cents
Wealth after this year: 192 cents

[Continue](#)

Note: Screenshot of full compliance screen.

Figure A13: Audit

Tax audit

You were selected for a tax audit!

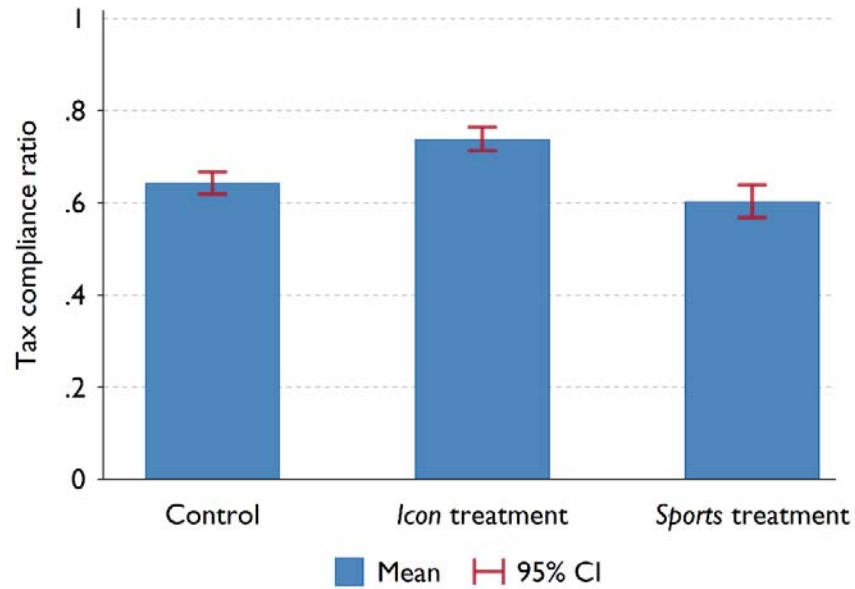
There was a difference between your declared income and the income you reported of 72 cents.

A fine of 32 cents has been deducted from your income this round on top of the full tax amount of 22 cents.

[Continue](#)

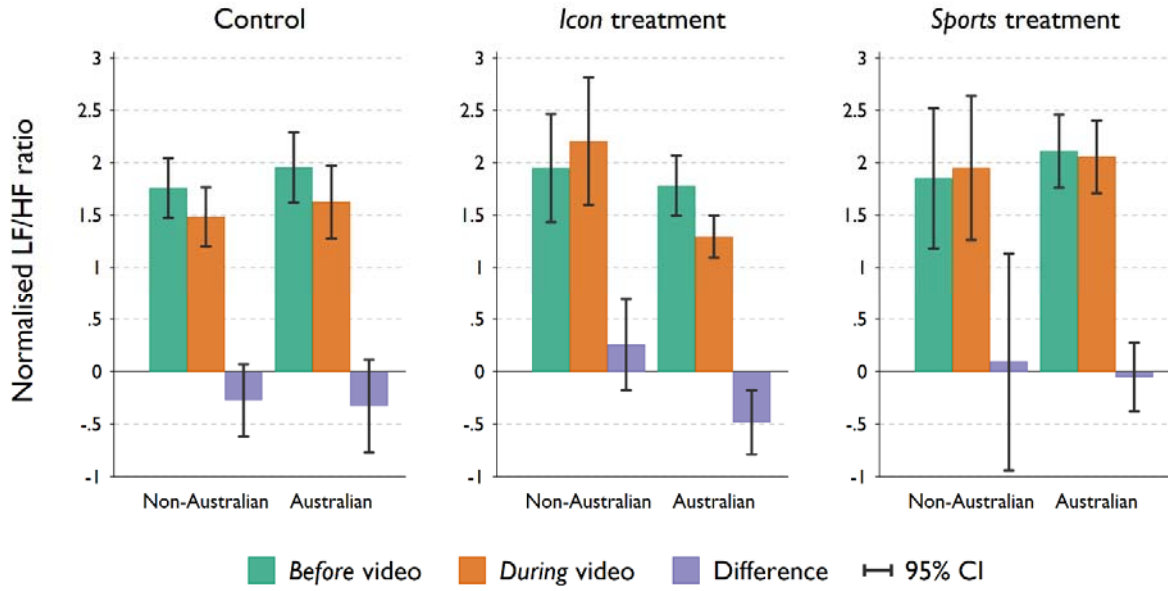
Note: Screenshot of audit outcome.

Figure A14: Tax Honesty by Treatment



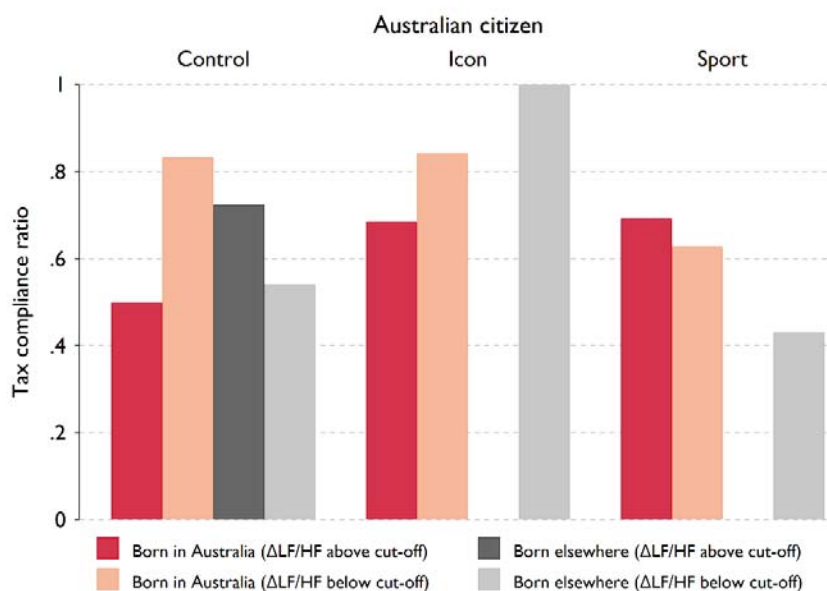
Note: Effect of treatment on average *tax compliance ratio*. Participants in the treatment using iconic images to trigger national pride demonstrated a higher level of compliance relative to those in the control. Error bars represent 95% confidence intervals.

Figure A15: Sensitivity of HRV and Change in HRV using Median



Note: The figure shows the *median* normalised LF/HF ratio (stress indicator) before and during the video framing and the corresponding difference. Error bars represent 95% confidence intervals.

Figure A16: Tax Honesty of Australian Participants by Treatment, Country of Birth, and HRV



Note: The figure shows the average level of *tax compliance* of Australian participants by their country of birth (red bars represent participants were born in Australia and grey bars represent participants who were born elsewhere). Caution should be exercised when interpreting the results due to the small number of foreign-born Australian participants.

Figure A17: Instructions

Introduction

Thank you for participating in this experiment. The purpose of the experiment is to study how people make decisions. If you have any questions at any time, please raise your hand. Please do not speak to other participants during the experiment and please turn off your mobile phone now. We also ask you not to reveal any details about the experiment after you have participated.

You will receive \$5 for arriving on time. Depending on your decisions during the experiment, you will receive an additional amount. At the end of the experiment, you can privately collect the final amount in cash in a sealed envelope from the Economics and Finance front office (in room Z804).

You are free to leave the experiment at any point. If you have any concerns or queries at all please raise your hand and an experiment administrator will assist you.

Information:

This is an experiment in the economics of tax declaration. The experiment will consist of 20 rounds. Each round represents one year and proceeds in three stages.

First stage: Earn your income

In the first stage of each year you will be given a fixed sum of 36 cents (which is your tax adjusted \$5 show up fee divided across the 20 years of the experiment). You will earn additional income by solving up to 10 'sum of digit' problems. The sum of digit problem requires that you sum up the individual digits of a 3-digit number, e.g. for the problem 123 the solution would be $6=1+2+3$. You will receive 12 cents for each correct solution you enter. You will have 20 seconds to answer as many as possible.

Second stage: Declare your income

In the second stage you will then be asked to declare your income. All the information to make an informed decision will be provided on the screen.


Third stage: Tax calculation and audit

In the third and last stage each year, the taxes payable on your declared income will be deducted from your income. Your net income accumulates as 'wealth'. In this stage, there is also a 10% chance that you will be selected for audit, and your declared income will be checked against your real income in this year. If there is a discrepancy between your stated and your real income, a fine of 1.5 times the amount of tax you owe will be deducted from your income this year.

Please note that all taxes and fines collected during this experiment will be paid directly to the Australian Tax Office (ATO).

Note: ATO version

Figure A18: Instructions

	PARTICIPANT INFORMATION FOR QUT RESEARCH PROJECT – Economic Experiment –
Experimental Investigation of Incentivised Decision-Making	
QUT Ethics Approval Number 1300000142	

DESCRIPTION

This study investigates human behavior in the presence of incentives. The experimenters are testing theories involving incentives in order to better understand how individuals make decisions as individuals and in groups. This research is important to increase our understanding about how people make day to day decisions and in turn can help to shape public policy on important issues such as superannuation, insurance, etc.

In this study, you will participate in one or more decision-making scenarios, or “experiments.” In each experiment, you will make a series of choices. Your payoff will be affected by your own choices as well as the choices of other participants in the experiment. In addition to your behavior in the experiment we will also record your heart rate during this experiment, please refer to the sheet “Information about the heart rate monitor devices” for details.

You were selected as a possible participant in this study as you have indicated that you wished to be part of an experimental participant pool within Queensland University of Technology (QUT), in which case you accepted an emailed invitation to participate.

If any of the following apply, you are not eligible to participate in today's session:

- You are under 17 years of age.
- You are in a position of authority over or authority under one of the experimenters in this session (e.g., an employer/supervisor or an employee of one of the experimenters).
- You are a current student of one of today's experimenters.

If any of these apply to you, please inform an experimenter before this session begins.

PARTICIPATION

Your participation in this project is entirely voluntary. If you do agree to participate you can withdraw from the project at any time without comment or penalty. If you withdraw, on request any identifiable information already obtained from you will be destroyed. Your decision to participate or not participate will in no way impact upon your current or future relationship with QUT (for example your grades).

This experiment will go for one hour. There are 0 follow up sessions that you will be required to attend to receive your full payment.

Your choices involve a set of monetary incentives, in which case you will receive a monetary payment based on the outcome of your decisions. This is an experiment in the economics of tax declaration. The experiment will consist of 20 rounds. Each round represents one year and proceeds in three stages. You will be required to do a series of calculations that involve adding together 3 numbers.

You will be given a practice of the procedures to be used in the experiment and if you have any questions during this time or during the experiment itself, please raise your hand and a researcher will come to assist you.

EXPECTED BENEFITS

There are no anticipated direct benefits for you from participation in this study. However you will receive a payment consisting of two parts:

1. The show-up payment (usually \$5), which is a flat amount of \$5 given to everyone in this session.
2. The performance payment, which you will earn based on your particular performance in this session (and which could be as low as \$0 and also could contain an additional flat amount).

In summary, you will not earn less than \$ 5, and you may earn additional money through your performance in today's experiments. You will receive your total payment (i.e., the show-up payment plus the performance payment) in cash at the end of today's session.

RISKS

There are no risks beyond normal day-to-day living associated with your participation in this project.

Figure A19: Attach HRV monitor

Information about the heart rate monitor devices

The heart rate monitor devices used in this experiment provide accurate measurements about the heart's activity, which can be used to create an electrocardiogram (ECG). The device is completely non-intrusive, small in size, and provides very high resolution data recording. It is connected to the chest with three electrode pads which have adhesive backings for easy application and a moist center to allow for good conductivity. The ECGs produced by these devices will be used in this experiment to study the physiological re-actions participants have to different situations. Previous research has shown that it can also be used to infer information about mental processes.

1 What data is recorded?

Data are recorded by measuring the electrical impulses emitted when the heart contracts. The device can also detect respiration rates, using the same mechanism. This is done at a very high frequency of 750 Hz, to guarantee a good signal. Figure 1 shows an example what the recorded data looks like.



Figure 1: ECG data.

2 Application of the electrodes

For the device to work properly, the electrodes have to be attached exactly as depicted in Figure 2.

The red cable is to be attached to an electrode placed in the middle of your collar bones.

The black cable is to be attached to an electrode to the sternum, in the middle of your chest.

The green cable is to be attached to an electrode one finger space under your left breast.

For men: Strong hair growth might interfere with measurement or electrode removal.

For women: Please do not apply lotions to skin in places where the electrodes are attached.

Once the experiment is completed the electrodes can be peeled off, and any residual adhesive can be removed from the skin with an alcohol pad.

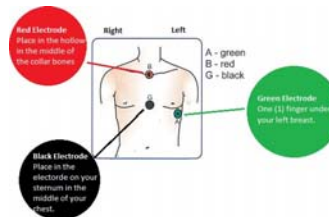


Figure 2: How to apply the electrodes.

3 How does the device work?

The device is small and can be carried in a pocket, placed on the desk at your cubicle, or carried in a belt case. It is operated with two buttons. Press and hold the upper button for a few seconds to turn the device on. Hold both buttons down for several seconds to turn the device off. The device screen will flash the power symbol, indicating the device has been turned on appropriately.

Check the positioning of the electrodes and to ensure that the colour of the cables is as laid out in Figure 2.



Figure 3: Holter Medilog Digital ECG Recorder AR4 and AR12.

Note: Instructions on attaching HRV monitor

Figure A20: Attach HRV monitor

Information about the heart rate monitor devices

The heart rate monitor devices used in this experiment provide accurate measurements about the heart's activity, which can be used to create an electrocardiogram (ECG). The device is completely non-intrusive, small in size, and provides very high resolution data recording. It is connected to the chest with three electrode pads which have adhesive backings for easy application and a moist center to allow for good conductivity. The ECGs produced by these devices will be used in this experiment to study the physiological reactions participants have to different situations. Previous research has shown that it can also be used to infer information about mental processes.

1 What data is recorded?

Data are recorded by measuring the electrical impulses emitted when the heart contracts. The device can also detect respiration rates, using the same mechanism. This is done at a very high frequency of 4096 Hz, to guarantee a good signal. Figure 1 shows an example what the recorded data looks like.



Figure 1: ECG data.

2 Application of the electrodes

For the device to work properly, the electrodes have to be attached exactly as depicted in Figure 2.

The red cable is to be attached to an electrode placed near your heart, two fingers below your left breast.

The black cable is to be attached to an electrode directly under the collarbone.

The green cable is to be attached to an electrode three fingers under your right breast.

For men: Strong hair growth might interfere with measurement or electrode removal.

For women: Please do not apply lotions to skin in places where the electrodes are attached.

Once the experiment is completed the electrodes can be peeled off, and any residual adhesive can be removed from the skin with an alcohol pad.

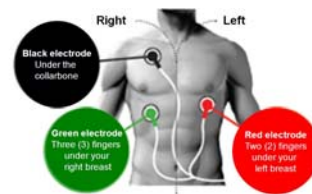


Figure 2: How to apply the electrodes.

3 How does the device work?

The device is small and can be carried in the pocket, placed on the desk at your cubicle, or carried in a belt case. It is operated with a single button. Press and hold the button for a few seconds to turn the device on or off. An orange light will indicate that the device is starting up. Once the initialization is completed, a green light will flash to indicate that the device is working properly. If the orange light persists, this is a sign that the device is not functioning as designed. Check the positioning of the electrodes and to ensure that the colour of the cables is as laid out in Figure 2.

4 How to use the device

While you fill out the questionnaire, please firmly press the button of the device every time you encounter a post-it note. Remove the post-it note when you press the button.



Figure 3: Holter Medilog Digital ECG Recorder AR4 and AR12.

Note: Instructions on attaching HRV monitor

Figure A21: Questionnaire first screen

Questionnaire

The experiment is finished now, please answer the following questions while we prepare your payment.

What is your year of birth?

Please indicate your gender.
 Male Female

What is your average disposable income per week?

What is your course of study?

Please indicate your level of study.
 Undergraduate Postgraduate

Overall, how would you rate your performance at university?
 Well above average
 A little above average
 Average
 A little below average
 Well below average

Have you ever participated in economic experiments before?
 Yes No

How many of the participants in this session do you know personally?

Were you born in Australia?
 Yes No

Note: Questionnaire first screen

Figure A22: Questionnaire for those born in Australia

Questionnaire

How proud are you to be Australian?
 Very proud
 Quite proud
 Not very proud
 Not at all proud
 Don't know

What thing are you most proud of in your country?

Of course, we all hope that there will not be another war, but if it were to come to that:
Would you be willing to fight for your country?
 Yes No

Do you think you are a typical Australian?
 Very typical
 Somewhat typical
 Neither typical nor atypical
 Not that typical
 Very atypical

Note: First screen of questionnaire for those born in Australia

Figure A23: Questionnaire for those born in Australia continued

• When Australians are praised, I feel pleased:

Strongly agree
 Agree somewhat
 Neither agree nor disagree
 Disagree somewhat
 Strongly disagree

I feel closely connected to other Australian people.

Strongly agree
 Agree somewhat
 Neither agree nor disagree
 Disagree somewhat
 Strongly disagree

• I like being Australian:

Strongly agree
 Agree somewhat
 Neither agree nor disagree
 Disagree somewhat
 Strongly disagree

[Next](#)

Note: Second screen of questionnaire for those born in Australia

Figure A24: Questionnaire for those born overseas

Questionnaire

Please enter the country in which you were born.

How long have you been in Australia (in years)?

Are you an Australian citizen? Yes No

How proud are you to be your nationality?

Very proud
 Quite proud
 Not very proud
 Not at all proud
 Don't know

What thing are you most proud of in your country?

Of course, we all hope that there will not be another war, but if it were to come to that:
Would you be willing to fight for your country? Yes No

Note: First screen of questionnaire for those born overseas

Figure A25: Questionnaire for those born overseas continued

Do you think you are typical of someone from your home country? Very typical
 Somewhat typical
 Neither typical nor atypical
 Not that typical
 Very atypical

When people from my home country are praised, I feel pleased:
 Strongly agree
 Agree somewhat
 Neither agree nor disagree
 Disagree somewhat
 Strongly disagree

I feel closely connected to people of my nationality.
 Strongly agree
 Agree somewhat
 Neither agree nor disagree
 Disagree somewhat
 Strongly disagree

Note: Second screen of questionnaire for those born overseas

Figure A26: Questionnaire for those born overseas continued

I feel closely connected to Australian people.
 Strongly disagree
 Strongly agree
 Agree somewhat
 Neither agree nor disagree
 Disagree somewhat
 Strongly disagree

I like being my nationality:
 Strongly agree
 Agree somewhat
 Neither agree nor disagree
 Disagree somewhat
 Strongly disagree

[Next](#)

Note: Third screen of questionnaire for those born overseas

Figure A27: Questionnaire for all continued

Questionnaire

Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people? most people can be trusted
 you can't be too careful

Please select how strongly you disagree or agree with each statement below.

	Trust them completely	Trust them lots	Neither trust nor distrust them	Do not trust them very much	Do not trust them at all
How much do you trust your family?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much do you trust other people from your home country in general?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much do you trust people you know personally?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much do you trust other people of another nationality?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much do you trust other people from another religion?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Note: Second screen of questionnaire for all

Figure A28: Questionnaire for all continued

Please indicate whether you think the following can always be justified, never be justified, or Justified something in between?

	Never justified	Justified something in between							Always justified
Cheating on tax if you have the chance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Claiming state benefits to which you are not entitled	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Someone accepting a bribe in the course of their duties	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Throwing away litter in a public place	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Driving under the influence of alcohol	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Which political orientation do you identify with?

- Left
- Centre Left
- Centre
- Centre Right
- Right

Apart from weddings, funerals and christenings, how often do you attend religious services these days?

- More than once a week
- Once a week
- Once a month
- Once a year
- Less often than once a year
- Never

Note: Third screen of questionnaire for all

Figure A29: Questionnaire for all continued

Do you have any comments, ideas or suggestions for improvements?

[Next](#)

Note: Fourth screen of questionnaire for all

Figure A30: Questionnaire for all continued

If you recognised the music in the video, please write it here?

If you cheated on your taxes at any stage during the experiment, would you say you felt a sense of guilt about it?

- Strongly agree
- Agree somewhat
- Neither agree nor disagree
- Disagree somewhat
- Strongly disagree

If you were caught cheating on your taxes by the audit, would you say you felt a sense of shame?

- Strongly agree
- Agree somewhat
- Neither agree nor disagree
- Disagree somewhat
- Strongly disagree

[Next](#)

Note: Fifth screen of questionnaire for all

Figure A31: Questionnaire for all final screen

FINISHED

The experiment is finished now, please wait for instructions to collect your payment.

Note: Final screen of questionnaire for all

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