"Good enough? Pro environmental behaviour, climate change and moral licensing."

Abstract

Policies aiming at promoting sustainable lifestyle have been flourishing in the last decades, with unknown global impact. It is a common assumption to believe that encouraging pro environmental behaviour (PEB) in one domain would lead to increased environmental behaviour in other situations (best-case scenario) or just be restricted to the initial target (worst-case scenario). Evidence from an emerging literature on moral licensing suggests that interventions targeting behavioural change could lead to an even worse situation, with individuals starting to underperform, as a compensation for their good performance (negative spillovers). We propose to study empirically (study 1) and experimentally (study 2) the dynamic of PEB across domains. Study 1 shows that PEB in one domain, unless associated to climate change beliefs, is not indicative of further PEB in other domains. In Study 2, we found that priming could increase PEB, but does not thwart moral licensing. Primed individuals may end up doing worse than non-primed individual under a moral licensing condition. We conclude that a more comprehensive view of the mechanisms underlying behavioural change (through formal education vs priming) is essential in order to support sustainable environmental policies.

1. Introduction

Over the last several years policy makers have engaged in a range of behaviour change initiatives aimed at reducing the carbon footprints of households and communities. Information campaigns as well as economic incentives and "nudges" of various types have been used to encourage the adoption of more sustainable practices across a range of areas (from recycling to transport to energy saving, to food), with mixed results (for a recent review of international evidence see Southerton et al 2011; Viscusi et al, 2011; Al-Ubaydli and Lee, 2011; Allcott, 2010). Evaluations of the effectiveness of these initiatives are fraught with many complex issues, the most prominent of which is that initiatives generally evaluate the carbon footprint reduction that results from the specific initiative adopted (say reduced household emissions from energy saving), without addressing the effect that the initiative may inadvertently have on other behaviours which also affect an individual's overall footprint (Gilg et al, 2005).

A growing literature on the dynamic of moral behaviour illustrates a high level of complexity in the way individual make decisions over time (Truelove et al., 2014). Moral licensing, the idea that people may off-set their virtuous deeds by feeling entitled to behave more self-indulgently afterward, offers new perspective to approach pro-environmental behaviour and the global impact of environmental programs (Khan and Dhar, 2006; Mazar and Zhong, 2010; Blanken et al., 2015; Mullen and Monin, 2016). In light of this theory, an internal balancing mechanism between good and bad deeds prevents individuals from reaching their long-term goals. This present paper proposes to investigate the potential for 'green licensing'. A better understanding of how individual behaviour interferes with environmental long-term goals and to what extent moral licensing may harm environmental policies seems crucial in helping to design effective policies: given that the goal is to reduce carbon footprints overall, any negative spillovers must be 'planned in'.

We first propose to discuss the existing evidence of potential negative spillovers in the environmental domain. We argue that this evidence faces at least two limits that do not enable to conclude for moral licensing in the environmental domain, namely the confounding role of an income effect on one hand and the artificial nature of the observed behaviour on the other hand. In a second part, we run a natural field experiment to test for moral licensing while attempting to address those limits by observing actual behaviour freed from monetary outcomes.

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The implicit expectation of behaviour change initiatives in the area of PEB is that once an individual has become more environmentally conscious in one domain, this will spread to a whole range of other choices. This rests on two assumptions: 1) that having more information about issues and caring about them encourages more action, and 2) that aside from practical resource constraints (essentially time and various forms of capital, including human capital) there is no upper limit to the amount of 'good' actions that individuals are willing to undertake. However, experimental evidence from behavioural economics suggests a more complex picture given that, whilst individuals care about the effect of their actions on others (social preferences or prosocial behaviour), they also experience self-control problems (moral licensing) (Khan and Dhar, 2006; Mazar and Zhong, 2010; Blanken et al., 2015; Mullen and Monin, 2016).

Moral licensing questions the sustainability of isolated measures targeting one specific domain (e.g. waste management, water use, energy consumption, purchase of local or organic food) in achieving a successful path to greener lifestyles at an aggregated level. The idea that people may off-set their effort in one domain by feeling entitled to behave more indulgently subsequently through moral licensing is emerging rapidly (see Blanken et al. 2015 for a meta study and Mullen and Monin 2016 for a comprehensive review).

For instance, the mixed results of carbon-offset programs are a good illustration. Major organizations engaged in releasing carbon off-sets, such as Responsible Travel, Yahoo or the United States House of Representatives have stopped their activity because "Offsets are distracting people from making more significant behavioural changes, like flying less." (Rosenthal, 2009) Relying on 202 individual interviews about sustainable lifestyle, Barr, Shaw and Coles (2011) highlighted this contradiction within individual lifestyle. Their findings reveal that people having greener habits at home were also those flying the most. People further argue that they deserved such flying as a reward for their green efforts.

In a field experiment, Tiefenbeck et al. (2013) show that targeted environmental campaigns on reducing water consumption (A water conservation campaign provided feedbacks on water consumption to randomly selected households while control household living in similar apartments did not receive such information), increased at the same time the electricity consumption compared to a control group. The authors suggest moral licensing as a possible explanation of the observed behavior. But this interpretation is controversial, and those findings could be the only result of a rebound effect: savings in water consumption may just have offset electricity bills' increase.

In a controlled lab experiment, Mazar and Zhong (2010) found that engaging individuals in green behaviors reduced subsequent cooperative actions and licensed individuals to lie and steal when subsequently tempted. More specifically, participants were randomly asked to purchase to either a green or a conventional on-line store, followed by a dictator game, were participants need to state the share amount of a given sum to an anonymous participant. Results show that participants in the green store condition shared less money than participants assigned to the conventional store. However, in this case again, the rebound effect cannot be entirely ruled out as alternative interpretation. Being assigned to a green store exposes participants to the purchase of more expensive products, which in turn affects individuals' disposable income and subsequent willingness to give.

Finally, looking at driving habits, a study in Science shows that Prius hybrid drivers are more likely to break crosswalk laws, get into accidents, and receive fines than drivers from conventional cars (Norton, 2012). One explanation given to this phenomenon is that prius hybrid driver, experience increased moral self-esteem by driving a pro-environmental car, which in turn lead them to more self-indulgent driving behavior. But, similarly to the evidence discussed earlier, this phenomenon could be the only result of a rebound effect, as driving faster with Prius cars becomes cheaper, and thus offsets fines' cost.

Overall, these studies suggests the existence of a moral licensing effect, but interpretation remains complex as they face the common challenge of confounding moral and economic factors (i.e. moral licensing versus rebound effect). By contrast, other researches in psychology have investigated the moral licensing effect in a different context, free from monetary outcomes, bringing complementary evidence for moral compensation.

In an experimental study, Sachdeva et al. (2009) found that subjects who wrote something positive about themselves gave one fifth of the amount given by those who wrote a story referring to negative traits to a charity. Asking people whether a job is better suited for Whites than for Blacks, Effron et al (2009) reported more racial discrimination among a group that had the opportunity to express support for Obama in an earlier task.

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If those studies make more salient the moral dimension of the compensation phenomenon, they rely on declarative statements and do not enable to infer about real behavior. In fine, natural evidence for green moral self-licensing is lacking.

3. Empirical study

To provide some background about green behavior in the UK population, we make use of the UK Understanding Society, an annual survey which follows around 40,000 UK household over time which began in 2009 as a successor to the UK BHPS longitudinal survey, and currently has seven available waves. The survey collects information on social and economic variables at the individual and household level. In waves 1 and 4 respondents were asked a number of questions about their beliefs in relation to climate change, environmental attitudes and green behaviour. We focus on wave 4 (undertaken in 2012 and 2013) as individuals were also asked the number of flights they had taken in the last 12 months. We focus on the general population and Northern Ireland sample and exclude the ethnic minority boost and BHPS samples so our sample is representative of the UK. We focus on those who responded to the self-completion questionnaire, since some of the questions we are interested in are only asked in the self-completion questionnaire which leads to a sample size of 22,360 individuals.

3.1. Descriptive variables
Details of how we constructed our variables is provided in appendix 1. Individuals are asked about a number of pro-enviornmental behaviour (PEB) and separate out altruistic and selfish acts so have created the following (normalised on a scale of 0 to 1, to allow comparison across the sum measures):

- Total number of green acts (summed across all PEBs)
- Total number of selfish acts (may be income motivated)
- Total number of altruistic acts:
- Total number of transport acts (excluding fewer flights):
- An indicator of whether they take fewer flights where possible for environmental reasons (always or very often)
- We grouped the total number of flights (UK and overseas) flown in the past 12 months into 0,1,2,3,4 and 5+.

We make use of three general questions that address whether they see themselves as environmentally friendly and having on impact on climate change: and
We also make use of the following attitudinal questions:

- Whether climate change affect UK in with 30 years, 31-200 years, no affect within 200 year
- It's not worth me doing things to help the environment if others don't do the same Any changes I make to help the environment need to fit in with my lifestyle -

In our analysis, we control for a number of personal socio-demographic characteristics, , personality and region. We are interested in the impact of having a degree and equivalised household income (using the OECD equivalised scale), as well as beliefs and attitudes to climate change. See appendix 2 for descriptive statistics of our control and dependent variables.

3.2 Analysing pro-environmental behaviours in a representative sample
In the following section, we analyse the link between PEB and 1) willingness to pay for environmentally friendly products and 2) number of flights.

3.2.1 PEB and Willingness to pay for environmentally friendly products

In table 1 (full results can be found in appendix 3), we examine the determinants of PEBs, and present results from models using the following dependent variables:

- My behaviour and everyday lifestyle contribute to climate change – coded as 1 if strongly agree or tend to agree, 0 otherwise; estimated using a probit estimator with average marginal effects reported

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- And which of these would you say best describes your current lifestyle? On a scale of 1 (I don't really do anything that is environmentally-friendly) to 5 I'm environmentally-friendly in everything I do for now, estimated using OLS
- *I would be prepared to pay more for environmentally friendly products — coded as 1 if strongly agree or tend to agree, 0 otherwise, estimated using a probit estimator with average marginal effects reported*
- Number of green selfish acts, number of green altruistic acts and number of green transport acts (all normalised on a scale of 0-1); estimated using OLS
- *Number of flight categories (0,1,2,3,4,5+), estimated using an ordered probit model*
- *Whether take fewer flights for environmental reasons*

18.1% describe themselves as environmentally friendly in most/everything they do, with 40.5 saying they do quite a few things. Whilst 41.4% say they don't do anything or only one or two things that are environmentally friendly. 34.7% are willing to pay more for environmentally friendly products. It is evident that more people do selfish green acts with 97% saying they do at least one, than altruistic acts with 68% saying they do at least one, whilst 46.5% state they do at least one transport related act. Only 4.8% state that they have flown less for environmental reasons. 55.5% state they have not flown in the last 12 months, with an average of 2.4 flights for those who have flown.

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Table 1: Determinants of Pro Environmental Behaviour

	Behaviour impacts on CC (0-1): Probit	Environmentally friendly (1-5)	Pay more environmental products: Probit	No of selfish green acts (0-1)	No of altruistic green acts (0-1)	No of transport green acts escluding fewer flights (0-1)	No of flights (0-5)	Fewer flights (0/1): Probit
Degree and above	0.122***	0.056***	0.119***	0.029***	0.055***	0.014***	0.366***	0.022***
	[0.008]	[0.013]	[0.007]	[0.004]	[0.004]	[0.004]	[0.024]	[0.003]
Equivalised monthly household income ('000)	0.012***	-0.006	0.021***	-0.007***	-0.001	-0.008***	0.212***	-0.002
	[0.002]	[0.004]	[0.002]	[0.001]	[0.001]	[0.001]	[0.010]	[0.001]
Climate Change Beliefs (ref: no affect within 200 years)								
CC affect UK within 30 years		0.231***	0.213***	0.055***	0.042***	0.013**	0.017	0.013***
		[0.021]	[0.009]	[0.006]	[0.005]	[0.006]	[0.027]	[0.005]
CC affect UK 31-200 years		0.096***	0.035***	0.019***	-0.003	-0.005	0.066*	0.000
		[0.025]	[0.011]	[0.007]	[0.006]	[0.007]	[0.034]	[0.006]
Not worth help environment if others don't do the same		-0.179***	-0.048***	-0.018***	-0.018***	-0.009**	-0.008	-0.005
		[0.013]	[0.007]	[0.004]	[0.004]	[0.004]	[0.019]	[0.003]
Environmental changes have to fit lifestyle		-0.097***	0.005	-0.021***	-0.021***	-0.016***	0.050***	-0.007**
		[0.011]	[0.006]	[0.004]	[0.003]	[0.003]	[0.018]	[0.003]

		[0.011]		[0.006]	[0.004]	[0.003]	[0.003]	[0.018]	[0.003]

Observations	22,360	22,360		22,360	22,360	22,360	22,360	22,360	22,360
(pseudo) r-squared	0.031	0.106		0.077	0.051	0.122	0.088	0.162	0.051

Standard errors in brackets

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

Includes control for gender, ethncity, age, marital status, dependent children, employment status, personality and region

Probit results reported are average marginal effects

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Table 1 shows that those with a degree and above are the ones who are most likely to think their behaviour impacts on CC, more likely to pay for environmentally friendly products and do more selfish altruistic, and transport related green acts. Those with a degree and above fly the most but also are more likely to report they have taken fewer flights for environmental reasons. Also interesting, income has no statistically significant impact on reporting being environmentally friendly; those with higher income report doing fewer selfish green and transport green acts and fly more, but are willing to pay more for environmental products.

In addition, the role of beliefs deserves special attention. First, individuals thinking that climate change will affect UK within 30 years are willing to pay more for green products and do more green activities (including transportation) than others, and take fewer flights for environmental reasons However, negative beliefs about others' cooperation makes conditional co-operators (Not worth help environment if others don't do the same) doing significantly worse than the others. They are less likely to pay for environmentally friendly products and do less good deeds (including selfish, altruistic and transport related) than others. In addition, those who feel environmental changes have to fit lifestyle (a proxy for effort) are less likely to be green in all aspects and are no more likely than those who don't feel environmental changes have to fit lifestyle to pay for environmental friendly products (i.e. the coefficient is not statistically significant).

Result 1: ***Willingness to pay for green products is not necessarily associated to greener lifestyle* - High-income individuals have a greater willingness to pay for environmentally friendly products than others, but are also more likely to report non-environmentally friendly lifestyles.**

Result 2: *Being environmentally friendly does not necessarily translate into greener lifestyle across other domains.* Individuals feeling green and doing good for the environment through their consumption or energy use might also be less likely to go for green transportation and fly more than others.

Result 3: *Beliefs significantly affect PEB.* Negative beliefs about climate change make people consistently more environmentally friendly across domains and negative beliefs about cooperation make conditional co-operators consistently less environmentally friendly across domains.

3.2.2 PEBs and Flying

We now present results from analysing the relationship between PEBs and flying, were the moral struggle becomes more evident. In table 2, we show flight categories (classified from 0 to 5+) and PEBs, using the number of acts split into selfish, altruistic and transport as explanatory variables.

Table 2: Ordered Probits: Flight Categories and PEB

	Without controls	With controls	No education	No Income	No income/education	Interaction
Degree and above		0.335***		0.463***		0.353***
		[0.019]		[0.018]		[0.029]
Equivalised monthly household income						

	(1)	(2)	(3)	(4)	(5)	(6)
Equivalised monthly household income ('000)		0.168***	0.188***			0.185***
		[0.005]	[0.005]			[0.008]
Climate Change Beliefs (ref: no affect within 200 years)						
CC affect UK within 30 years		0.042	0.065**	0.064**	0.101***	0.042
		[0.028]	[0.028]	[0.028]	[0.027]	[0.028]
CC affect UK 31-200 years		0.076**	0.079**	0.085**	0.091***	0.077**
		[0.034]	[0.034]	[0.034]	[0.034]	[0.034]
Not worth help environment if others don't do the same		-0.010	-0.022	-0.016	-0.035*	-0.011
		[0.019]	[0.019]	[0.019]	[0.018]	[0.019]
Environmental changes have to fit lifestyle		0.043***	0.053***	0.049***	0.065***	0.042**
		[0.017]	[0.017]	[0.016]	[0.016]	[0.017]
Green Behaviour						
Number of selfish acts	-0.164***	-0.134***	-0.115***	-0.165***	-0.144***	-0.134***
	[0.031]	[0.032]	[0.032]	[0.032]	[0.031]	[0.032]
Number of altruistic acts	0.135***	0.010	0.061*	0.019	0.094***	0.145***
	[0.031]	[0.034]	[0.034]	[0.034]	[0.033]	[0.056]
Number of green transport acts	-0.110***	-0.043	-0.036	-0.089***	-0.087***	-0.042
	[0.031]	[0.033]	[0.033]	[0.033]	[0.033]	[0.033]
Number of altruistic acts*Equivalised household income						-0.051***
						[0.020]
Number of altruistic acts*Degree and above						-0.055
						[0.069]
Observations	22,360	22,360	22,360	22,360	22,360	22,360

Standard errors in brackets

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

Includes control for gender, ethncity, age, marital status, dependent children, employment status, personality and region

Without controls, individuals doing more selfish green acts and more green transport acts fly less but those who do more altruistic acts fly more (column 1). The latter effect could suggest some moral licencing but disappears when we add the usual controls. (column 2) It reappears if we drop income and education (column 5). We know from table 1 that those who have a higher education level do more altruistic acts whilst those with higher income do not do significantly more (i.e. the coefficient is negative but insignificant). We know that both those with more education and those with income fly more. If we exclude only education the effect is positive but only significant at the 10% level and then excluding income (but not education) makes it insignificant. The last column interacts the number of altruistic acts with those with a degree and above and also income level. We can see the positive effect of altruistic acts (which is positive and statistically significant) is less for those with a degree and above (although this is not statistically significant) and the effect reduces as income gets higher (this is statistically significant). Also the number of green transport acts becomes insignificant when we control for income and becomes significant again if we exclude income.

Result 4: *Education and income play a significant role in the relationship between green acts and flying* (i.e. people doing more green acts flying more than others). The analysis further suggests that education acts as a mediator of the effect, while income might have a predominant (but decreasing) explanatory role.

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In Study 1, we found evidence for several paradoxes in PEB. Environmental concerns in one domain do not necessarily spread across domains. Impact studies relying on single indicators may therefore be misleading. The results further show the determining role of education in tempering green licensing (i.e. compensation between green acts and flying). If we found that doing more green acts lead to flying more (as previously pointed out in Barr et al, 2011), we also found that education dampen the effect. The role of education is reinforced by Result 3, which underlines the positive link between beliefs about climate change and consistent environmental behaviour across domains. Altogether, education could play a fundamental role in shaping social and moral values, offering greater control over green licensing. Along these lines, it raises the potential for informational nudges such as behavioural priming as a promising tool for cost-efficient mobilization of social and moral values. This will be further explored in our second study, presented in part 4.

4. Priming and licensing effects on green behaviour: a field experiment

The mechanism that leads people to behave consistently or even increase their green behaviours in repeated events (positive spillovers) rather than off-setting them (negative spillovers) remains an open question. Experiments in behavioural priming and moral regulation have shown that exposure to green products and their purchase has opposite effects: exposure primes ethical behaviour whilst purchasing can license asocial and unethical behaviour (Mazar and Zhong, 2010). But what happens if both happen at the same time (as it is mostly the case in real settings)? Could the positive impact of being primed persist? Or will a licensing task (i.e. buying carbon off-sets) dampen the positive effect of priming (i.e. receiving environmental information on global warming) and lead to subsequent moral licensing (i.e. decrease pro environmental behaviour)?

This experiment aims at testing the potential of behavioural priming to act on social and moral values by reducing negative spillovers, and thus enforcing morally consistent behaviour. In addition, the experiment aims at complementing the existing literature on moral licensing (discussed in part 2) by observing actual behaviour while removing the potential concomitant effect of economic compensation (= rebound effect).

We design an experiment to test: 1) moral licensing on actual behaviour within the environmental domain, 2) the interaction between priming and licensing on subsequent PEB.

4.1. Experimental design and procedure
The experiment took place at the University of Reading in the UK during spring 2016. Undergraduates from the economics department participated in this between-subjects experiment as part of their lecture.
We designed this experiment with three objectives in mind. First, we want to test for moral licensing in the environmental domain without monetary choices involved, to disentangle the moral from the potential rebound effect suspected in earlier studies. Second, we aim at testing moral licensing on natural behaviour, in contrast to standard lab experiment. Our experiment belongs to the natural field experiment category, meaning that subjects do not know they are participating in an experiment, which ease the observation of actual behaviour.

The experimental design is a modified version of Mazar and Zhong (2010) and consists in one control (no priming) and two treatments (priming vs. priming + licensing). The first task is based on a product rating exercise, followed by a filler task, to minimize the possibility that participant notice a link with the subsequent part of the experiment. The outcome variable is measured through recycling behaviour (i.e. whether papers administered for the experiment are placed in the general waste bin or the recycle bin).

More specifically, in the first step of the experiment, participants had to rate products on two criteria: 1) the design of the packaging and 2) the informativeness of the description. One third of participants in a control group were exposed to a list with a majority of conventional products (4 conventional products, 1 green product) while the other two thirds were primed through exposure to a list containing a majority of green products (4 green products, 1 conventional product). We further completed this design by giving the option to half of the primed group to sign a petition to support the Paris Climate Agreement. This first step was

through exposure to a list containing a majority of green products (4 green products, 1 conventional product). We further completed this design by giving the option to half of the primed group to sign a petition to support the Paris Climate Agreement. This first step was thus made of three groups, as summarized in table 3: Group 1 (control), exposed to conventional products, Group 2 (treatment 1), exposed to green products, Group 3 (treatment 2), also exposed to green products, but with the additional opportunity to sign a petition. In a second step, all participants took part in a filler task, which consisted in rating a sweet. Comparing treatment 1 and control will give us some indication about the existence of a priming effect, while treatment 2 versus treatment 1 aims at testing the impact of a moral self-licensing effect on primed individuals, simply adding the petition task.

The instructions made clear to participants that papers (the A5 page instructions and a smaller envelope with the sweet, both enclosed in a larger envelope) should be placed in bins while leaving the room. The experimenter (different from the lecturer) red aloud the instruction before the experiment started. In addition, the following sentence "Please, do not forget to take all the papers with you and throw them in the bin when you leave the room!" was mentioned both in the paper and in the online instructions (see appendix 5). This was also to ensure that participants do not leave the room with the papers, in which case we would have lost observations. Step 3 consisted in recording individual recycling behaviour by tracking the set of envelope and instruction.
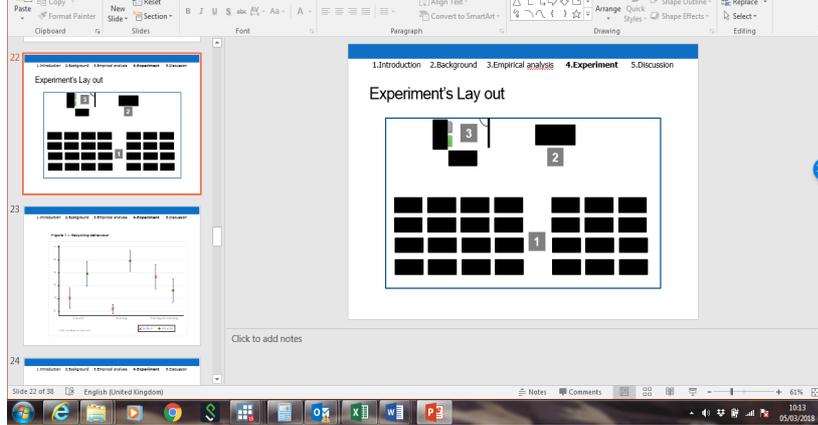
Table 3 – Experimental design

	Control No priming	Treatment 1 Priming	Treatment 2 Priming + Licensing
Step 1	Product rating (4 conventional / 1 green)	Product rating (4 green/ 1 conventional)	
Step 2	Filler task		
Step 3	-	-	Licensing task (Petition)
Step 4	Record recycling behaviour		

Before participants entered the room, both the tablet and a big envelope (containing the instructions and the smaller envelope) were disposed on tables, making sure to keep enough space between students for privacy purposes. Each set of instruction and envelope were numbered in order to ensure anonymity, but also to keep track of individual recycling behaviour. Instructions sets corresponding to control or one of the two treatments were randomly placed within the classroom. As participants entered, they were asked to sit in front of a tablet. They were told that they would participate in a survey for research, which would consist in rating products on a list that would be made available on the tablets and that they would have a break at the end of the activity before the lecture started again. When ending the survey, participants were asked to raise their hands and stand up to give their tablet back upon invitation of the experimenter before to leave the room to take their break (which also enabled to regulate participants way out and avoid congestion by the bins). Before leaving the room, all participants could read the following sentences: "Thank you for your participation. Please raise your hand to tell the instructor that you have completed the survey. The instructor will call you to give the tablet back. Thank you for leaving the room quietly while taking your break. Please do not forget to take all the papers with you and throw them in the bin when you leave the room." Finally the bins were placed nearby the doors, clearly visible on the way out, but still hidden from the rest of the room by tables on which we put various materials on top (such as tablet's bags and paper stack) in order to minimise peer effects (See Figure 1 for a graphical representation of the experimental lay out and process.)

Figure 1 – Experiment's lay-out (1: complete survey; 2: hand tablets back; 3: throw papers on the way out)
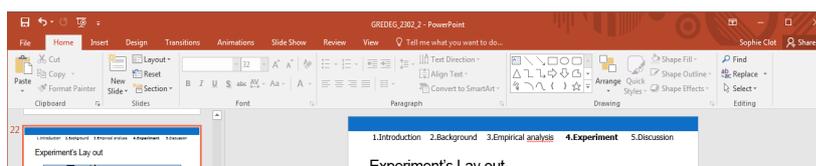
An originality of our design is that it builds on the advantage of two different experimental methods. First, it takes from lab experiments with control settings and standard procedures enabling further replications and establishing clear relationship between the measured outcome and our independent variables. Second, the outcome variable (i.e. recycling) is measured through actual behaviour (and not an artificial task), such as in natural field experiments, with participants not knowing this would be part of the research and thus avoiding a so-known demand effect. In sum, this design aims at providing information of natural behaviour without sacrificing the benefits linked to controlled settings.

4.2. Results

We collected 85 observations that were equally balanced among the 3 treatments. Observations in this case correspond to a set of numbered envelopes and instructions, with three possible outcomes, categorised in 3 variables: 1) for the use of the recycle bin, 2) for the use of general waste bin and a last 3) for the non-use of bins (a significant portion of papers were just left on tables or on the floor after the experiment ended). Because the experiment was scheduled before a break (and not before the end of a lecture), there is no missing information (participants that would have left with the papers in their bags).
Our main findings are summarized below. Further illustrations, statistical tests and regressions analysis are discussed in subsequent paragraphs.

Result 1: *Priming increases green behaviour*. Participants in the priming treatment were significantly more likely to use the recycle bin than participants in the control group (+19.95 points, p<10%). They were also less likely to not use bins (-17.12 points, p <10%)

Result 2: *The licensing task dampens the effect of priming and leads to a significant decrease in green behaviour*. Overall, participants in the licensing treatment used significantly less the recycling bin than participants in the priming treatment (-46.43 points, p<1%). In parallel, they were more likely to not use bins than the primed group (49.6 points, p<1%).

Figure 2 and table 4 summarize our findings. Figure 2 compares the distribution of participant's behaviour between treatments and control. In table 4, we present the percentage of recycling behaviour among our 3 sub-groups along with two different statistical tests (Fisher exact test and Pearson Chi2)

Figure 2 – Distribution of behaviour towards waste between control and treatments, whole sample (with Fisher's exact statistical significance)
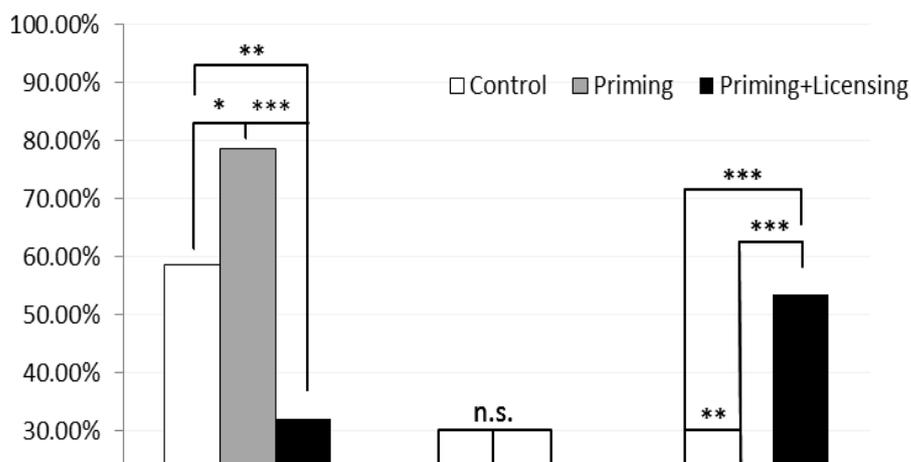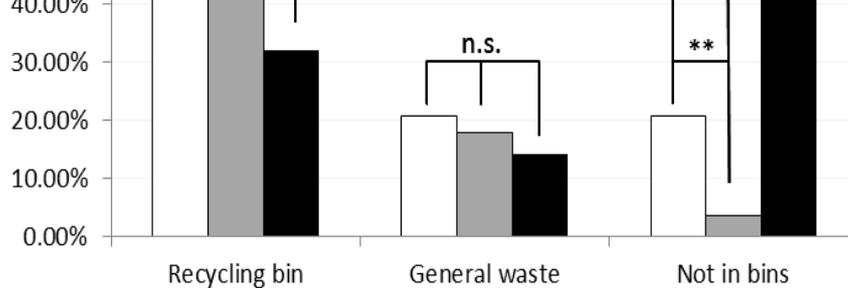
Table 4 – Percentage of recycling behaviour among control and treatments with Pearson Chi2 and Fisher exact tests.

	Control (n=29)	Priming (n=28)	Priming + Licensing (n=28)	Pearson chi2 p-Value	Fisher's exact p-Value
Recycling bin	58.62%	78.57%	32.14%	0.002	0.002
General waste	20.69%	17.86%	14.69%	0.949	1
Not in bins	20.69%	3.57%	53.17%	0.000	0.000

Finally, we run an ordered probit model with behaviour towards waste as a dependant variable (1=recycle bin; 2=general waste; 3=non-use of bins) to test the impact of priming and licensing. We controlled for group fixed effects as well as sensitivity to green products (an indicator we built based on the product's rating survey capturing the difference between green and standard products' ratings). The probit model (table 5) confirms previous results and highlights the significant and positive role of priming on recycling behaviour along with the negative effect of the licensing task dampening the priming effect and worsening recycling behaviour.

Table 5 – Ordered probit model – Dependant variable: recycling behaviour (1=recycle bin; 2=general waste; 3=non-use of bins)

	Coef.	SE	Z	P>|z|
Treatment 1 (Priming)	-0.608	0.348	-1.74	0.081
Treatment 2 (Priming+Licensing)	0.852	0.319	2.67	0.008
Senstitivity to green products *(Average green product rating-Average standard product rating)*	0.152	0.171	0.89	0.374
Group fixed effect	-0.162	0.167	-0.97	0.332
Obsevations	85			
Chi2	20.45			
P	0.0004			

Overall, this experiment brings evidence for the existence of a moral licensing effect in the environmental domain. By nudging individuals to actually do good for the environment, we also promoted subsequent negative spillovers with people being less likely to use bins as requested. Signing the petition, or the moral boost associated to having done something good, may have distracted participants from the other request of recycling (common to all participants, with a reminder at the end of the instructions), while priming exacerbated it. Did that happen under the radar of consciousness? Did participants consider they had pleased the experimenter enough with signing the petition so there was no need to do more? Why and how do people engage in self-licensing remains an open question. But at least, this result illustrates the need to consider for potential negative spillovers when promoting green behaviour and assessing the impact of programme over the long run.

and how do people engage in self-licensing remains an open question. But at least, this result illustrates the need to consider for potential negative spillovers when promoting green behaviour and assessing the impact of programme over the long run.

5.   Conclusions and further research

Study 2 brings additional evidence for moral licensing using a natural field experiment. We found that subjects who did something good for the environment (signing a pro-environmental petition) were more likely to adopt sluggish behavior afterwards, by decreasing their effort in correctly sorting their paper waste. More specifically, we do find positive spillovers for priming (being exposed to green products make you more likely to sort paper waste correctly), but the positive spillovers are not robust to the licensing condition where individuals engage some effort in another good deed, suggesting the importance of repeated and comprehensive measure of individual behaviour when assessing the impact of a given targeted programme. So far, we focused on intra domain compensation, with good deed in one domain licensing for bad deeds in a connected domain. For instance, would the positive spillovers measured through recycling in the non licensed group lead to further spillovers, with those individuals more likely to self indulge in other domains? What time period should be considered?

To some extent, our work may suggest an interesting avenue for further research, that is to say the role of beliefs versus emerging priming techniques in adopting consistent pro environmental behaviour. If the results from the Study 1 suggest that people with strong beliefs behave consistently towards the environment, Study 2 underlines the non-persisting effect of priming. Primed individual may react positively at first, but if that generates some level of internal conflict (being unconsciously pushed to do something you may not have done independently), then self-licensing may emerge.

Those findings underline the importance of education to promote PEB while calling for extreme care when using priming techniques, as they may not prevent from counterproductive effects.

Our findings warrant further investigation given the potentially important implications for policy design: if our results are validated with additional evidence it will be possible to estimate the size of these substitution effects to find ways to increase PEBs without incurring offsetting. As things stand, policies to encourage more pro-environmental behaviour need to confront the possibility that there are thresholds after which both behaviour change and pigouvian taxes may not be effective.

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Appendix 1: Variable creation

- *Pro-Environmental Behaviour*

PEB were asked on a scale of always to not very often (coded as 0/1 variables, coded as 1 if always or very often (never or not very often for 1 and 3)   - those who said don't know or can't do this were coded as 0):

1. Leaves TV on standby overnight
2. Switches off lights in empty rooms
3. Let tap run whilst brushing teeth
4. Wear extra rather than turn up heating
5. Doesn't buy because of excess packaging
6. Buys recycled products
7. Takes own bags shopping
8. Use public transport rather than take car
9. Walk or cycle for short journeys less than 2 or 3 miles
10. Car share with others who need to make a similar journey - 1
11. Take fewer flights when possible for environmental reasons

To make the interpretation of PEB more manageable and to separate out altruistic and selfish acts we have created the following (the sums were divided by the number of PEBs so normalised on a scale of 0 to 1, to allow comparison across the sum measures):

- Total number of green (summed across all PEBs)
- Total number of selfish (may be income motivated) – selfish were tv off, lights off, tap off, wear extra clothes
- Total number of altruistic acts: low packaging, buy recycled, own bags (prior to bags being charged for),
- Total number of transport acts: take public transport, walk/cycle, car share

bags (prior to bags being charged for),
- Total number of transport acts: take public transport, walk/cycle, car share
- An indicator of whether they take fewer flights where possible for environmental reasons (always or very often)

- *Flying*

Individuals are also asked if they have flown to somewhere in the UK, Europe or outside of Europe and the number of flights in the past 12 months We grouped the total number of flights flown in the past 12 months into 0,1,2,3,4 and 5+.

- *Beliefs and attitudes towards climate change*

Individuals are asked a number of questions to capture their beliefs about/attitudes to climate change and their green behaviour. We make use of three general questions that address whether they see themselves as environmentally friendly and having on impact on climate change:

- My behaviour and everyday lifestyle contribute to climate change – coded as 1 if strongly agree or tend to agree, 0 otherwise
- And which of these would you say best describes your current lifestyle? On a scale of 1 (I don't really do anything that is environmentally-friendly) to 5 I'm environmentally-friendly in everything I do for now
- I would be prepared to pay more for environmentally friendly products –- coded as 1 if strongly agree or tend to agree, 0 otherwise

We also make use of the following attitudinal questions:

- Whether climate change affect UK in with 30 years, 31-200 years, no affect within 200 year
- It's not worth me doing things to help the environment if others don't do the same – coded as 1 if strongly agree/tend to agree, 0 otherwise
- Any changes I make to help the environment need to fit in with my lifestyle –- coded as 1 if strongly agree or tend to agree, 0 otherwise

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Appendix 2: Descriptive Statistics

Variable	Mean	sd	min	max
Personal characteristics				
Female	0.57	0.50	0	1
white	0.94	0.25	0	1
Age Group				
Aged 16-24	0.09	0.29	0	1
Aged 25-34	0.13	0.34	0	1
Aged 35-49	0.28	0.45	0	1
Aged 50-64	0.27	0.44	0	1
Aged 65+	0.23	0.42	0	1
Marital status				
Single and never married	0.18	0.39	0	1
Married	0.54	0.50	0	1
Cohabiting	0.12	0.33	0	1
Divorced/separated	0.09	0.29	0	1
Widowed	0.06	0.24	0	1
Age of Youngest Child				
Aged 0-2	0.08	0.27	0	1
Aged 3-4	0.04	0.20	0	1
Aged 5-11	0.11	0.31	0	1
Aged 12-15	0.05	0.22	0	1
No dependent children under 16	0.72	0.45	0	1
Highest Qualification				
Degree and above	0.25	0.43	0	1
Other higher	0.13	0.34	0	1
A-level	0.20	0.40	0	1

	Mean	SD	Min	Max
Degree and above	0.25	0.43	0	1
Other higher	0.13	0.34	0	1
A-level	0.20	0.40	0	1
GCSE	0.20	0.40	0	1
Other qualifications	0.10	0.30	0	1
No qualifications	0.11	0.32	0	1
Employment Status				
Employed	0.58	0.49	0	1
Inactive	0.09	0.28	0	1
Retired	0.25	0.44	0	1
In FT education	0.04	0.20	0	1
Unemployed	0.04	0.20	0	1
Equivalised household income	2.09	1.48	0	20
Personality				
Agreeability	5.63	1.04	1	7
Conscientiousness	5.50	1.10	1	7
Extraversion	4.60	1.32	1	7
Neuroticisim	3.57	1.45	1	7
Openness to experience	4.56	1.31	1	7
Government Office Region				
North west	0.12	0.32	0	1
North east	0.05	0.21	0	1
Yorkshire	0.08	0.27	0	1
East Midlands	0.08	0.27	0	1
West Midlands	0.08	0.27	0	1
East of England	0.10	0.30	0	1
London	0.07	0.26	0	1
South East	0.14	0.35	0	1
South West	0.11	0.31	0	1
Wales	0.05	0.22	0	1
Scotland	0.08	0.27	0	1
Northern Ireland	0.04	0.20	0	1
Climate Change (CC) Variables				
Climate Change Beliefs				
CC affect UK within 30 years	0.78	0.42	0	1
CC affect UK 31-200 years	0.13	0.33	0	1
CC not affect UK within 200 years	0.10	0.30	0	1
Not worth help environment if others don't do the same	0.27	0.44	0	1
Environmental changes have to fit lifestyle	0.40	0.49	0	1
Behaviour impacts on CC	0.45	0.50	0	1
Environmentally friendly	2.72	0.86	1	5
Pay more for environmentally friendly goods	0.35	0.48	0	1
Number of selfish green acts	0.62	0.26	0	1
No of altruistic green acts	0.30	0.25	0	1
No of transport green acts (excluding fewer flights)	0.21	0.25	0	1
Fewer flights	0.05	0.21	0	1
No of flights	0.90	1.32	0	5

n=22,360

Appendix 3: Full Results Table 1 -

No of
transport

	Behaviour impacts on CC (0-1): Probit	Environmentally friendly (1-5)	Pay more environmental products: Probit	No of selfish green acts (0-1)	No of altruistic green acts (0-1)	No of transport green acts escluding fewer flights (0-1)	No of flights (0-5)	Fewer flights (0/1): Probit
Female	-0.001	0.081***	0.002	0.007*	0.064***	-0.000	0.006	0.007**
	[0.007]	[0.012]	[0.007]	[0.004]	[0.003]	[0.004]	[0.018]	[0.003]
white	-0.078***	-0.060**	-0.078***	-0.025***	-0.007	-0.020***	0.069**	-0.012*
	[0.014]	[0.026]	[0.013]	[0.007]	[0.008]	[0.008]	[0.034]	[0.006]
Age Group (ref: 35-49)								
Aged 16-24	-0.106***	-0.225***	-0.050***	-0.046***	-0.121***	0.064***	-0.007	0.014
	[0.017]	[0.029]	[0.015]	[0.009]	[0.008]	[0.009]	[0.037]	[0.009]
Aged 25-34	-0.036***	-0.076***	-0.035***	-0.023***	-0.052***	0.033***	0.091***	0.003
	[0.012]	[0.019]	[0.010]	[0.006]	[0.006]	[0.006]	[0.029]	[0.005]
Aged 50-64	-0.015	0.113***	0.041***	0.014**	0.040***	0.001	0.033	-0.005
	[0.011]	[0.017]	[0.010]	[0.006]	[0.005]	[0.005]	[0.028]	[0.005]
Aged 65+	-0.064***	0.207***	0.091***	0.014	0.053***	-0.009	-0.166***	-0.017***
	[0.016]	[0.028]	[0.016]	[0.008]	[0.008]	[0.008]	[0.044]	[0.006]
Marital status (ref: single and never married)								
Married	0.017	0.063***	-0.017	-0.006	0.020***	-0.077***	0.228***	0.012***
	[0.012]	[0.020]	[0.011]	[0.006]	[0.006]	[0.006]	[0.028]	[0.005]
Cohabiting	0.010	0.028	-0.006	-0.005	0.016**	-0.053***	0.123***	0.004
	[0.013]	[0.022]	[0.013]	[0.007]	[0.007]	[0.007]	[0.031]	[0.005]
Divorced/separated	0.002	0.006	-0.064***	0.023***	-0.004	-0.029***	0.042	0.005
	[0.015]	[0.026]	[0.014]	[0.008]	[0.008]	[0.008]	[0.035]	[0.006]
Widowed	-0.027	-0.002	-0.019	0.002	-0.001	-0.040***	0.016	0.011
	[0.018]	[0.033]	[0.017]	[0.009]	[0.009]	[0.009]	[0.042]	[0.008]
Age of Youngest Child (ref: no dependent children under 16)								
Aged 0-2	0.015	-0.058**	-0.055***	-0.026***	-0.018***	-0.002	-0.424***	-0.014***
	[0.014]	[0.023]	[0.013]	[0.008]	[0.007]	[0.007]	[0.033]	[0.005]
Aged 3-4	0.052***	0.003	-0.024	-0.000	-0.016*	-0.014	-0.333***	-0.003
	[0.018]	[0.029]	[0.017]	[0.010]	[0.009]	[0.009]	[0.040]	[0.007]
Aged 5-11	0.020	-0.022	-0.031***	-0.002	-0.013**	0.006	-0.193***	-0.014***
	[0.013]	[0.020]	[0.012]	[0.007]	[0.006]	[0.006]	[0.031]	[0.005]
Aged 12-15	0.009	0.003	-0.042***	-0.005	0.008	-0.009	-0.088**	-0.005
	[0.016]	[0.026]	[0.015]	[0.008]	[0.008]	[0.008]	[0.040]	[0.007]
Degree and above	0.122***	0.056***	0.119***	0.029***	0.055***	0.014***	0.366***	0.022***
	[0.008]	[0.013]	[0.007]	[0.004]	[0.004]	[0.004]	[0.024]	[0.003]
Employment Status (ref: Employed)								
Inactive	-0.053***	0.039*	-0.003	0.013**	0.016**	0.001	-0.270***	-0.019***
	[0.012]	[0.022]	[0.012]	[0.006]	[0.006]	[0.006]	[0.025]	[0.006]
Retired	-0.019	0.179***	0.023*	0.049***	0.044***	0.021***	-0.021	0.000
	[0.013]	[0.023]	[0.012]	[0.007]	[0.007]	[0.006]	[0.038]	[0.006]
In FT education	0.094***	0.159***	0.063***	0.057***	0.015	0.069***	-0.004	-0.001
	[0.020]	[0.034]	[0.019]	[0.011]	[0.010]	[0.012]	[0.047]	[0.008]
Unemployed	-0.015	0.009	0.003	0.018**	0.008	0.087***	-0.259***	-0.020**
	[0.017]	[0.032]	[0.016]	[0.009]	[0.009]	[0.009]	[0.034]	[0.008]
Equivalised monthly household income ('000)	0.012***	-0.006	0.021***	-0.007***	-0.001	-0.008***	0.212***	-0.002
	[0.002]	[0.004]	[0.002]	[0.001]	[0.001]	[0.001]	[0.010]	[0.001]
Personality								

('000)	0.012***	-0.006	0.021***	-0.007***	-0.001	-0.008***	0.212***	-0.002
	[0.002]	[0.004]	[0.002]	[0.001]	[0.001]	[0.001]	[0.010]	[0.001]
Personality								
Agreeability	0.003	0.034***	0.013***	-0.000	0.001	-0.002	-0.047***	0.002
	[0.003]	[0.006]	[0.003]	[0.002]	[0.002]	[0.002]	[0.009]	[0.002]
Conscientiousness	-0.010***	0.049***	-0.013***	0.013***	0.006***	0.001	0.021***	-0.004***
	[0.003]	[0.006]	[0.003]	[0.002]	[0.002]	[0.002]	[0.008]	[0.001]
Extraversion	-0.003	-0.007	-0.013***	-0.012***	-0.008***	-0.002	0.057***	-0.002**
	[0.003]	[0.005]	[0.002]	[0.001]	[0.001]	[0.001]	[0.007]	[0.001]
Neuroticisim	0.012***	-0.024***	-0.002	-0.004***	-0.003***	-0.001	-0.031***	-0.000
	[0.002]	[0.004]	[0.002]	[0.001]	[0.001]	[0.001]	[0.006]	[0.001]
Openness to experience	0.026***	0.062***	0.035***	0.007***	0.012***	0.008***	0.014**	0.007***
	[0.003]	[0.005]	[0.003]	[0.001]	[0.001]	[0.001]	[0.007]	[0.001]
Climate Change Beliefs (ref: no affect within 200 years)								
CC affect UK within 30 years		0.231***	0.213***	0.055***	0.042***	0.013**	0.017	0.013***
		[0.021]	[0.009]	[0.006]	[0.005]	[0.006]	[0.027]	[0.005]
CC affect UK 31-200 years		0.096***	0.035***	0.019***	-0.003	-0.005	0.066*	0.000
		[0.025]	[0.011]	[0.007]	[0.006]	[0.007]	[0.034]	[0.006]
Not worth help environment if others don't do the same		-0.179***	-0.048***	-0.018***	-0.018***	-0.009**	-0.008	-0.005
		[0.013]	[0.007]	[0.004]	[0.004]	[0.004]	[0.019]	[0.003]
Environmental changes have to fit lifestyle		-0.097***	0.005	-0.021***	-0.021***	-0.016***	0.050***	-0.007**
		[0.011]	[0.006]	[0.004]	[0.003]	[0.003]	[0.018]	[0.003]
Observations	22,360	22,360	22,360	22,360	22,360	22,360	22,360	22,360
(pseudo) r-squared	0.031	0.106	0.077	0.051	0.122	0.088	0.162	0.051

Standard errors in brackets

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

Includes control for region

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Appendix 4 – Conventional and Green products' lists

Appendix 5 -Instructions

Thank you for participating in this survey. This is an individual and anonymous survey. Please do not talk to other participants during this survey.

Please read carefully the following instructions:

You have been given an envelope and a tablet. The envelope contains this instructions set and another smaller envelop that you do not need to worry about now.

 1. To start the survey, switch on your tablet by pressing the home button
  (located in the tablet's bottom centre)

 2. To unlock the tablet, enter the following digits: **XXX**

2. To unlock the tablet, enter the following digits: **XXX**

3. You will need to enter a room name.

Please enter the following room name: XXX.

4. You will also need to enter your ID number.

Please enter the following ID number: **001**.

The rest of the instructions will be given while completing the survey on the tablet.

Please do not forget to collect and throw all the papers in the bins at your disposal
when leaving the room!