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June 2018

Centre for Climate Change Economics
and Policy Working Paper No. 306
ISSN 2515-5709 (Online)

Grantham Research Institute on
Climate Change and the Environment
Working Paper No. 269
ISSN 2515-5717 (Online)

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Communicating Resourcefully: A Natural Field Experiment on Environmental Framing and Cognitive Dissonance in Going Paperless

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Abstract

In a large-scale natural field experiment comprising 38,654 customers of a renewable energy supplier in the United Kingdom, we randomize environmental information and dissonance-inducing messaging to promote an active switch from paper to online billing. We find that environmental information and imagery is ineffective in inducing behavior change. Interestingly, the dissonance-inducing messaging weakly improves uptake by 1.2 percentage points among our main sample but backfires among a subsample of individuals with doctoral educations, decreasing uptake by 6.2 percentage points relative to a control group. Contrary to the majority of the literature on gender and environmental behavior, females in our sample are less likely to switch to paperless billing.

Keywords: Natural field experiment; message framing; cognitive dissonance; information provision; imagery; resource use; paperless billing
JEL: D12, D83, L21, Q29

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Preprint submitted to Ecological Economics

May 31, 2018

1. Introduction

Businesses and governments are increasingly turning to randomized experiments to discover means by which to increase profitability or pursue policy goals. In a number of contexts, social and private objectives coincide, creating opportunity for partnerships between researchers and businesses interested in either or both of said objectives. Companies with clear sustainability or corporate social responsibility objectives, or whose inputs to production are both socially and privately costly, may be especially motivated to identify cost-efficient means to improve their resourcefulness due to the increased competitiveness and profitability associated with such innovation (Porter and Van der Linde, 1995).

Behavioral social science research has paved a new path for governments to identify innovative and cost-effective means of achieving desired policy outcomes (Benartzi et al., 2017), and the private sector is increasingly pursuing similar strategies in search of low-cost efficiency gains (e.g., Allcott, 2011; Gosnell et al., 2016). Despite this growing trend, little research has been undertaken to understand the resourcefulness of interactions between businesses and their customers. How can companies maximize customers' voluntary participation in programs that increase the efficiency and resourcefulness of business-customer interactions? As a means of improving operational efficiency, the business sector has seen a rapid capitalization upon technological advancements, such as mobile phone applications and SMS, or automatic bill pay (ABP). However, encouraging or mandating enrollment in such programs may lead to consumer welfare loss.

For instance, Sexton (2015) demonstrates that enrollment in ABP increased average energy consumption by 4.0% for residential energy consumers and 7.3% for small- to medium-sized commercial and municipal customers. Thus, while enrolling customers in alternative bill pay schemes may decrease transaction costs for retailers and improve resourcefulness, the act may come at a cost in terms of customer satisfaction, convenience, financial awareness, and ultimately retention. Similarly, while defaulting energy customers into green tariffs increased adoption of such tariffs tenfold in a field experiment in Germany, the ethical implications of such nudges in terms of consumer welfare are highly debated (Ebeling and Lotz, 2015; Schubert, 2017). Instead, companies may offer customers the option to enroll themselves voluntarily, though status quo bias and potential costs (e.g., from increased consumption, as shown above) suggest that many consumers may refrain from opting in.

In a large-scale natural field experiment comprising 38,654 customers of a green energy supplier, we investigate means to facilitate such cost- and resource-efficient change without imposing the change upon the customer. Specifically, we explore a role for targeted messaging to promote an active switch to online (as opposed to paper¹) energy billing in the UK, where consumer research by a prominent consumer choice advocacy group has suggested that many customers either have a preference for, solely have access to, or may be harmed by involuntary discontinuation of paper billing ([Keep Me Posted, 2013](#)). We implement a fractional factorial design, randomizing (i) information on environmental damages associated with paper use and (ii) messaging rooted in theories of cognitive dissonance, a phenomenon centered upon a desire for consistency in self-perception, with (iii) vivid environmental imagery. The research design rests on the assumption that the customer base of Good Energy, a 100% renewable electricity supplier in the United Kingdom and our partner in this study, is characterized by high environmental preferences. In light of the social mission of Good Energy and its customers' selection into their customer base, we conceptualize a utility function characterized by social preferences and cognitive dissonance, designing interventions to manipulate these arguments.

We find that both imagery and information on environmental costs associated with the status quo are ineffective in increasing uptake of paperless billing beyond that of a control group. On the other hand, dissonance-inducing messaging increases uptake among our main sample. Our data allow for exploration of the roles of both gender and education, two demographic factors that have been shown to increase pro-environmental behavior ([Kollmuss and Agyeman, 2002](#)). We find significant heterogeneity of uptake, both broadly speaking and with respect to treatment. Interestingly, dissonance-inducing messaging backfires among our highly educated sample. To our knowledge, this study is the first to demonstrate such nuanced heterogene-

¹Excessive printing is costly from both a private and a social perspective. According to [Smith \(2011\)](#), printing costs constitute up to ten percent of corporations' revenue, and reducing paper use by ten percent among U.S. corporations alone could prevent 1.6 million tons—or 280,000 cars' worth—of greenhouse gas emissions annually. Moreover, continued rapid growth in household waste is becoming particularly problematic, comprising a majority of municipal solid waste globally ([Briguglio, 2016](#)).

ity among a large and presumably educated sample.² Additionally, the data suggest that women are less likely than men to sign up to paperless billing. Overall, the research suggests that individuals may be carefully targeted with various forms of messaging to increase environmentally advantageous behaviors at no additional cost, and calls into question the general conclusion in the literature that women are more inclined than men to behave in line with social or environmental objectives (Croson and Gneezy, 2009; Kollmuss and Agyeman, 2002).

The remainder of the paper is structured as follows. Section 2 reviews the relevant literature and provides a conceptual framework of behavior that motivates the experimental design. Section 3 outlines the experimental design and details the interventions implemented across Good Energy’s customer base. Section 4 reveals the results of the field experiment, and Section 5 concludes.

2. Literature Review and Conceptual Framework

Economics research on household cooperation in waste management—predominantly recycling behavior—has primarily focused on the role of convenience, incentives, intentions, attitudes, demographic characteristics, and moral considerations (see Briguglio (2016) for a review). A vast majority of this research aims to understand households’ waste-sorting behavior, with very few studies focused on illuminating the determinants of waste minimization. One example of the latter is a field experimental study on green nudges to deter junk mail, which demonstrated that mandated choice is more effective than active choice in overcoming status quo bias with respect to placement of “No Junk Mail” stickers on mailboxes (Liebig and Rommel, 2014). Furthermore, with scant literature on the role of communication in household waste decisions, there is a need for enhanced understanding of the role of costly and prevalent communication campaigns in addressing waste reduction objectives, as well as how these campaigns can be optimized for effectiveness (Briguglio, 2016). We begin this exploration by reviewing the relevant literature pertaining to the role of consequential information, cognitive dissonance, and imagery in human decision-making.

²Prior studies have demonstrated that education leads to higher green energy uptake (Jacobsen et al., 2013).

2.1. Information provision

Neoclassical economics holds that individual decision-making derives from rational maximization of one’s utility function with full information regarding the potential consequences of one’s actions. Evolutionary and economic theories—both within and outside of the utility maximization framework—have posited that such decision-making processes incorporate altruistic preferences, so that other-regarding considerations may play a role in decision-making (Becker, 1974; Andreoni, 1989, 1990; Simon, 1993). Similarly, while the rational economic man of neoclassical theory is primarily influenced by incentives, social psychology and behavioral economics reserve a role for nonstandard—e.g., non-egoistic, evaluative, normative, and identity-driven—beliefs and motivations in dictating personal norms that, in turn, influence behavior (Ajzen and Fishbein, 1980; Akerlof and Kranton, 2000; Elster, 2000; Stern, 2000; Kollmuss and Agyeman, 2002; DellaVigna, 2009; Nyborg, 2018). For instance, according to the norm-activation theory of Schwartz (1973) and the value-belief-norm (VBN) theory of Stern et al. (1999), knowledge of negative consequences associated with one’s actions—or particular undesirable conditions for which one is perceived to be responsible—spurs altruistic behavior. Therefore, information regarding particular externalities may change individuals’ beliefs and intentions, in turn altering their proclivity to engage in socially beneficial behaviors (Stern, 2000).

Empirically speaking—and despite the overwhelming tendency of social campaigns to communicate information with the goal of changing behavior (Bruvoll and Nyborg, 2004)—the impact of consequence-based information on subsequent behavior is quite unclear, showing promise in the lab while inducing mixed results in the field. Demand for such information is apparent in the laboratory experiment of Cain and Dana (2012), where a significant proportion (63%) of subjects chose to reveal the negative external consequences of their actions when given the opportunity to either reveal or remain ignorant. More surprisingly, 24% actually *paid* to become aware of such externalities. Of those who revealed, 44% and 50%, respectively, chose the more altruistic option, whereas all subjects who did not reveal made the selfish choice, consequently imposing a negative externality on their counterparts in the study. Remaining ignorant to the externality, therefore, allows for justification of action solely upon one’s own private utility (i.e., without regard for external costs).

However, interventions that impose consequence-based information in the field have not always demonstrated such an effect. A meta-analysis of in-

terventions intended to reduce household energy consumption demonstrates that information regarding externalities may increase knowledge but does not subsequently alter behavior (Abrahamse et al., 2005). On the other hand, Ferraro and Price (2013) find that information on the extent and consequences of water use among its (environmentally unconscious) customer base increased the implementation of water-saving strategies, especially among high-consumption households. Similarly, in a field experiment in Brazilian favelas, Toledo (2016) finds that environmental persuasion increases take-up of LED (energy-efficient) light bulbs by six percentage points (or 13%); however, it is important to note that subjects were asked to participate voluntarily and therefore the findings may suffer from selection bias.³

The interventions discussed here are applied to individuals who do not exhibit preferences for the environmental outcomes that constitute the focus of those studies. Yet, theory and empirical evidence to date suggest that such preferences may be instrumental in determining outcomes. For instance, in a Dutch mass media campaign surrounding the causes of and possible behavioral solutions for climate change, individuals who reported a higher willingness to engage in pro-environmental behaviors were those who had already been behaving in such a manner prior to the campaign (Staats et al., 1996). That is, information campaigns may be more effective in inducing (intended) behavior change among individuals already motivated prior to intervention. An important open question is whether environmental concern is a prerequisite for informational nudges to be effective (Ölander and Thøgersen, 2014).

³The consequences discussed here are externalities, or unintended costs of one’s actions that accrue to others outside of oneself. Responses to consequence-based information in the case of internalities are surprisingly weak. For instance, during well-child appointments in a Norwegian experiment, parents were randomly assigned to receive short informational briefings and brochures on smoking and its harmful passive effects on their children, after which self-reported smoking behavior did not change (Eriksen et al., 1996). Similarly, several field experimental studies demonstrate that information—including calories per item and recommended daily caloric intake—has no effect on subsequent order choice in fast food restaurants (Harnack et al., 2008; Downs et al., 2009). Likewise, an observational study found that extreme media coverage of the consequences of Enron’s accounting scandal on 401(k) holdings did not prompt employees in similar companies to diversify their 401(k) investments (Choi et al., 2005).

2.2. Cognitive dissonance

Once social information has been consumed and acted upon, it may be possible to create a virtuous circle by appealing to one's established identity with the cause (Akerlof and Kranton, 2000). Theories of cognitive dissonance originated in psychology and have since piqued the interest of a number of economists. The theories generally rest upon the premise that human beings are averse to inconsistencies between past or current beliefs and behaviors (Festinger, 1962). In a seminal experiment, Festinger and Carlsmith (1959) demonstrated that individuals who completed an hour-long mind-numbing task in the lab rated the task more positively if they had subsequently been paid larger sums of money to convince new recruits to do the task. In general, individuals strive for consistency, competence, and morality in their perceptions of themselves, such that behaving in a manner that negates these features results in psychological discomfort (Aronson, 1992). Such 'dissonance' is morally costly, and economic agents may incorporate these costs into their utility maximization problems.

According to Gilad et al. (1987), cognitive dissonance can manifest in situations in which "a decision is undertaken freely and with the understanding of possible adverse outcomes" (p. 64). In their theory of selective exposure, behavior remains consistent with traditional utility maximization if exposure to certain types of information can be controlled and dissonance kept at a level below some threshold, an assertion consistent with literature on information avoidance (Cain and Dana, 2012; Golman et al., 2015). Otherwise, the individual must adopt a costly change in her beliefs, and she will subsequently maximize in accordance with a revised objective function. Rabin (1994) proposes a similar structure for the utility function, adding a more nuanced explanation of the contexts in which cognitive dissonance will increase the tension between material benefit and psychological cost. For instance, he conjectures that an individual who receives low material benefit from an immoral activity will further convince herself of the immorality of the activity than an individual who receives relatively high material benefit. Interestingly, the author shows that a stronger proclivity toward cognitive dissonance may pressure an individual with high material benefit from said activity into changing her beliefs, thereby augmenting immoral activity.

A more recent interpretation of cognitive dissonance emphasizes the role of context in determining the extent to which one may rationalize decisions in light of one's beliefs. Mazar et al. (2008) put forth a theory of cognitive dissonance in which the propensity to engage in dishonest behavior is

dependent on individuals' mindfulness of and attention to their own moral standards. In several laboratory experiments, they find that individuals who have the opportunity to cheat do so, though they are less likely to cheat when reminded of their moral beliefs or after signing an honor code. The authors argue that the internal *salience* of self-concept is, therefore, an important driver of congruence between belief and behavior.

Two economic theories formalize this human desire for internal consistency. [Akerlof and Dickens \(1982\)](#) propose a two-period model in which a rational individual first chooses whether to participate in a safe or hazardous industry; if she chooses the latter, she will convince herself of the safety of the industry so as to justify her past decision. In the second period, a cost-effective safety device becomes available and the individual—who would have purchased the device had it been available prior to her perception change—continues to work without it.⁴ Similarly, [Konow \(2000\)](#) posits a utility function comprising material wealth along with two costly parameters: cognitive dissonance and self-deception. The former characterizes the deviation between one's beliefs and one's actions—in this case, the deviation between a fair allocation and one's actual allocation in a dictator game—while the latter captures the discomfort associated with altering one's initial fairness perspective to increase consistency between the aforementioned allocations. Lab experimental results from several variants of the dictator game, where subjects perform both active and passive roles, provide strong empirical support for both parameters.

Outside of the lab, social scientists have cited cognitive dissonance as a plausible explanation for voting behavior ([Mullainathan and Washington, 2009](#)), investor inertia ([Goetzmann and Peles, 1997](#); [Rennekamp et al., 2014](#)), sexual risk taking ([Mannberg, 2012](#)), diminished labor supply in the face of job search discrimination ([Goldsmith et al., 2004](#)), endogenous class formation ([Oxoby, 2003](#)), and honesty in the face of cheating opportunities ([Mazar et al., 2008](#)). Furthermore, the phenomenon has been exploited as a means to ends such as water use reduction ([Dickerson et al., 1992](#)), sustained weight

⁴According to the authors, the model justifies government regulation to mandate that hazardous industry workers wear the equipment in order to return to Pareto optimal conditions. While the model focuses on labor selection, it is also applied to explain the effectiveness of non-informational advertising, the incidence of crime under various degrees of sanctions, and the necessity of Social Security for individuals who are averse to acknowledging the inevitability of old age.

loss (Axson and Cooper, 1985), condom use (Stone et al., 1994), and reducing hypothetical bias in contingent valuation studies (Alfnes et al., 2010).

Perhaps most relevant to the present study, Kantola et al. (1984) implemented a framed field experiment (N=203, out of 429 initially contacted) where individuals who were reminded that they had previously expressed agreement with a statement claiming that individuals have a duty to save electricity reduced their consumption compared to a control group in a follow-up measurement period of four weeks. It is worthwhile to note that subjects were volunteers for the study who could participate only if they consented to have their energy use monitored throughout the study period, and (strongly) agreed with the statement, “It is your personal duty as a responsible citizen to conserve as much electricity as possible,” opening the possibility of selection bias and experimenter effects. Additionally, there is no mention of a balance check across treatment arms, raising the question of whether the study was truly randomized even within this self-selected sample. In a more recent series of field experiments on voting behavior, invoking the self-concept through use of a noun identifier (“to be a voter”)—as opposed to a verb (“to vote”)—in pre-election surveys significantly increased voter turnout, demonstrating that provision of “positive self-regard” may substitute for recognition from others for largely invisible behaviors (Bryan et al., 2011). To date, research has yet to target self-selected groups displaying particular preferences with dissonance-inducing messaging.

2.3. Imagery

Finally, a sparse empirical literature appears to suggest that imagery can play a role in behavior change. For instance, a series of lab experiments (Haley and Fessler, 2005; Burnham and Hare, 2007; Rigdon et al., 2009; Mifune et al., 2010) and field experiments on honesty, littering, and donating (Bateson et al., 2006; Ernest-Jones et al., 2011; Ekström, 2012) demonstrate that an image of eyes can cause individuals to comply with cooperative norms in some contexts. Additionally, money priming using imagery has been shown to lead people to make less altruistic decisions or to focus their attention on monetary features of products (see Vohs, 2015, for a review). Economic theory has little to say on the role of imagery per se on behavioral outcomes, though various types of imagery may serve to intensify emotions or increase the availability heuristic (Loewenstein, 1996).

2.4. Conceptual Framework

In light of the theories outlined above, we hypothesize that consumers of a renewable energy utility will respond to the experimental interventions below with increased uptake of online billing. In line with norm-driven theories from social psychology and theories of altruism from economics, we posit that information on environmental damage may trigger motivation to act altruistically if sufficiently strong. Additionally, subjects will respond to the cognitive dissonance intervention by switching from paper billing to online billing if the cost of induced dissonance sufficiently outweighs the perceived benefits of paper billing (i.e., convenience to the consumer and the value of expected energy savings associated with paper billing). We can conceptualize these decision tradeoffs in a microeconomic framework by imagining a utility function comprising utility from altruism and disutility from both excess consumption (including energy costs) and cognitive dissonance. In line with [Sexton \(2015\)](#), we assume that there is a weak increase in inattention to one’s energy costs when switching from paper billing to online billing, reducing households’ motivation to deviate from the status quo. The disutility arising from reduced salience of energy costs—and consequent increases in energy use—will be traded off with utility from consistency of self-perception (or avoided self-deception, as in [Konow, 2000](#)). Similar utility tradeoffs exist between increased energy costs and benefits arising from pure altruism or warm glow ([Andreoni, 1989](#)).⁵

Finally, as an exploratory hypothesis in line with the conclusion of [Taylor and Thompson \(1982\)](#) that vividness may be important in the context of everyday informational competition, we conjecture that environmental imagery may serve to enhance the salience of the above interventions. Increased attention would serve to augment the perceived social benefits or psychological congruence of going paperless and, therefore, the probability of doing so ([DellaVigna, 2009](#)).

3. Experimental design

We build upon the above literatures using a large-scale natural field experiment ([Harrison and List, 2004](#)) to implement treatments that either appeal

⁵Households that switch may also derive utility from reduced waste, decreased storage costs, or convenience.

to an embedded environmental preference or that target a preference for consistency in self-perception, with the aim of encouraging renewable gas and energy consumers to switch from paper billing to online billing (i.e., a one-off, low-cost behavior). We partnered with Good Energy—one of the UK’s leading renewable energy suppliers—to randomize email content in a campaign to encourage 38,654 customers to switch from their current billing channel (i.e., quarterly paper bills received via mail) to online billing (i.e., quarterly bills received via email). As a business founded upon an environmental mission, Good Energy’s objective in undertaking the research partnership was to achieve a switch rate as close to universal as possible; additionally, online billing constitutes an operational cost reduction, as it requires fewer physical and human resources than does paper billing. The six-week campaign ran in September and October of 2014.

To investigate a role for consequence-based information provision in promoting resourceful behavior, we provided customers with information on the environmental consequences of continuing to receive communications by mail (*environmental framing*). To understand the role of cognitive dissonance, we promoted present decision making consistent with one’s implicit environmental identity by making this identity salient (*cognitive dissonance*), as in [Mazar et al. \(2008\)](#). In contrast to [Samuelson and Zeckhauser \(1988\)](#), who claim that cognitive dissonance contributes to status quo bias, we test whether cognitive dissonance can be leveraged to mitigate *against* it. It is important to note that environmental framing may also play a role in inducing cognitive dissonance by making the individual aware of the external costs of their current behavior; therefore, we do not measure a “pure” effect of cognitive dissonance, but rather an “additional” effect of making such dissonance particularly salient. Finally, the design also allows for testing of the importance of vivid imagery on customers’ decision making. The selected imagery displays numerous bright green trees in a forest and was selected for its bright, vivid aesthetic as well as its relevance to the environmental goal of tree-saving.

The experiment rests upon the assumption that Good Energy’s customers possess stronger than average preferences for environmental welfare. This assumption is supported by the utility’s mission, energy prices, and customer acquisition data. Good Energy’s stated mission at the time of the study was “to keep the world a habitable place by offering consumers an active role in addressing climate change.” It was the sole utility that sourced 100% of its electricity from renewable sources. Additionally, while Good Energy’s

prices are comparable with the Big Six Standard tariffs (i.e., those paid by approximately 60% of UK residents), Good Energy’s customer base is overwhelmingly comprised of consumers who are engaged in the energy market and, therefore, actively switch. While Good Energy’s tariffs are in the 75th percentile of available tariffs in its market, its customers pay a premium of approximately 25% compared to the cheapest available tariff, suggesting that their motivation is not strictly monetary. Finally, while Good Energy customers’ consumption is quite similar to the average consumption in the UK, they are primarily ‘ABC1’ (i.e., consumers characterized by relatively high socioeconomic status, education, and income). Thus, their consumption may be relatively low when dwelling size is taken into consideration, suggesting energy consciousness.

3.1. Interventions

The subject line of each email announces the arrival of the online billing (“e-billing” below) option, and emails are sent from Good Energy’s Chief Operating Officer. The defining features of each email intervention are detailed below.

Control (Groups 1-2). In the control email, the first line unveils the online billing option (*availability line* hereafter, emphasis included): “**It’s finally here!** Now you can switch to e-billing and have your energy bills emailed directly to your inbox rather than receiving them by post.” The subsequent line touts online billing access (*online access line* hereafter): “Even better, you can access your bills online any time, so they won’t fill any valuable space in your drawers or bins.” Both of the previous lines appear identically across all interventions.

The key following control statement reads, “**Here at Good Energy, we prioritise customer satisfaction.** The opportunity to switch to e-billing is just one more step we have taken to keep you smiling.” Three benefits of switching are subsequently listed: 1) Reduce paper waste; 2) spend less time sorting through mail; and 3) access bills 24/7 online. The email includes a link to make the switch, and all emails contain the same closing statement followed by a signature from the Chief Operating Officer (for full email, see Figure A1 in Appendix).

Environmental Framing (Groups 3-4). This treatment provides information on the environmental benefits associated with a universal shift of Good Energy customers to online billing. Following the availability line stated above, this treatment states (emphasis included): “**If all customers**

make the switch, we would save 46 trees worth of paper each year!”
This line is followed by the online access line.

In addition to emphasizing Good Energy’s attention to customer satisfaction, the next line also points out its commitment to the environment (emphasis included): “**Here at Good Energy, we prioritise customer satisfaction as well as the environment.** The opportunity to switch to e-billing is just one more step we have taken to keep you smiling and help you shrink your environmental footprint.” The subsequent benefits no longer appeal to the customer herself, but rather are informative of the extent of paper waste and its environmental costs. The first bullet states, “The average UK family throws away 6 trees worth of paper in their household bin each year.” The second pertains to the energy and climate impacts of the paper industry as a whole: “Paper production ranks 3rd and 4th for most energy intensive and greenhouse gas intensive manufacturing industries (respectively).” Finally, we provide aggregate paper use statistics for the UK: “12.5 million tonnes of paper and cardboard are used annually in the UK, making us the 11th worst paper offender in the world.” The email closes as indicated in the control description (for full email, see Figure A2 in Appendix).

Control and Environmental Framing (Groups 5-6). While the content contained in the above treatment email is roughly the same length and format as the control email, it contains some different information. Therefore, we also test whether provision of the environmental information (presented to Groups 3 and 4) in addition to the control information (provided to Groups 1 and 2) is effective, allowing us to control for the otherwise non-incremental change in content from one email to the next (see Table 1). All information from both the control and the environmental framing email is aggregated into one email (for full email, see Figure A3 in Appendix).

Cognitive Dissonance (Groups 7-8). Our final treatment quite closely emulates the control email with the exception of a single line, so that length and format are quite similar. Instead of emphasizing customer satisfaction, this email appeals to one’s identity as a conscious decision maker (emphasis included): “**As a Good Energy customer, you are an environmental steward.** By switching to e-billing, you take another important step to eliminate the environmental impact of your energy use.” The remainder of the email is identical to the control email (for full email, see Figure A4 in Appendix).

Environmental Image (Groups 2, 4, 6, and 8). Finally, we test the effectiveness of imagery—a central and customary component of Good

Energy’s communications strategy—in capturing customers’ attention. For each of the above emails, an additional intervention existed using the same email content, but with the inclusion of a vibrant image of trees at the outset (see Figure A5 in Appendix). That is, apart from the image, all other content in the emails remained identical.

3.2. Sample

The main sample consists of 36,810 Good Energy customers, which is the entire customer base omitting those for whom a working email address had not been provided or for whom gender could not be identified. This sample is 47% female. The average customer had been with Good Energy for 315 days and consumed 6450 kilowatt-hours (kWh) in gas and 3435 kWh in electricity on an annual basis. Customers who were on a dual fuel account (i.e., who have both gas and electricity accounts with Good Energy) comprise 41% of the sample, while those with gas or electricity alone constitute 6% and 53%, respectively.

A separate analysis is performed for those identified as either “Doctor” or “Professor”—who are, therefore, gender neutral in the data—of which there are 1844 customers (approximately 5% of the sample).⁶ Of these customers, the average customer duration was 320 days, average annual gas and electricity consumption were 7592 kWh and 3546 kWh (respectively), and 41%, 7%, and 52% were on dual fuel, gas, and electricity contracts (respectively) in 2014. The difference in the two samples is significant for annual gas consumption ($p < 0.01$) and proportion of gas-only customers ($p < 0.10$). We control for all of the above observables in the analysis.

More generally, the customers of Good Energy are fairly representative of UK households more broadly in terms of energy consumption and costs. In our data, the average estimated annual energy consumption is 3668 kWh, while the average UK household in 2014 consumed 4001 kWh. On the other hand, Good Energy gas customers use slightly more gas (13,827 kWh) than the average British household (12,404 kWh; [Goodright and Wilkes, 2015](#)). Additionally, customers in our data likely pay similar prices per kWh. Due to increased competitiveness of renewable energy in the UK energy market, Good Energy customers pay a competitive price for their energy. On

⁶We are powered ($\beta=0.8$, $\alpha=0.05$) to detect treatment effects of approximately 0.02 (approximately 15%) in the main sample, and 0.10 (approximately 25%) in the postgraduate sample.

average, while dual fuel customers of the UK’s largest (“Big Six”) energy providers (i.e., those providers supplying over 90% of domestic customers) paid approximately £1360 per household in 2013, Good Energy households paid £1313. Similarly, compared to Ecotricity—one of Good Energy’s primary competitors in the UK renewable energy market—Good Energy dual fuel customers paid £55 less per annum. Therefore, cost of energy does not distinguish Good Energy households from other UK households.

3.3. Randomization

All observable variables in the dataset were used in the stratified randomization.⁷ Specifically, customers were sorted according to the fuel type associated with their accounts (gas only, electric only, or dual fuel), their estimated annual consumption (partitioned into quartiles), the length of their contract with Good Energy (partitioned into deciles), and the gender of the account holder (male, female, unidentified). We first sorted customers according to the three fuel types, and within each fuel type we blocked them according to the estimated annual total consumption quartiles, creating twelve blocks. Having sorted the data into these twelve blocks, we then sorted customers in each block according to duration of existing contract with Good Energy, followed by the account holder’s gender. If all blocks had contained at least one customer, this would have created $12 \times 10 \times 3 = 360$ blocks in total. However, there are nine blocks (i.e., combinations of the above variables used for stratification) for which no customer in the dataset is representative, so the stratification created 351 blocks in total. Once the data is sorted according to the existing 351 blocks, a number (1–8) is assigned to each account holder to allocate each customer to one of the eight treatments described above.

Since Good Energy’s email server was limited in terms of the volume of emails that could be sent in one day, the trial was planned for six weeks. We tested for pre-experimental equivalence across all group pairs on the above

⁷We perform the analysis with and without controlling for strata. Standard errors are slightly inflated without strata, and we report these slightly more conservative estimates (results controlling for strata are available upon request). Qualitatively, the results remain entirely intact, which is unsurprising given the finding in [Bruhn and McKenzie \(2009\)](#) that all randomization methods will achieve balance as sample sizes become large.

variables as shown in the balance table (see Table 2a).⁸

4. Results

4.1. Treatment effects

In total, 13.42% of customers signed up for online billing. We first note that imagery does not encourage adoption. In almost all cases, the email without the image outperformed that with the image. While the difference is not statistically significant when comparing all treatments without images to all treatments with images (χ^2 -test; $p=0.122$), the difference is significant when comparing the cognitive dissonance treatments with and without images (χ^2 -test; $p=0.054$). Thus, vivid imagery does not increase the salience of the message in a meaningful way, weakly attenuating effects that appear when the image is absent.

We therefore focus our attention in this section on treatment-control comparisons for interventions without imagery. Simple chi-square tests do not reveal significant differences across treatments with varying messages in the full sample (see Table A1 in Appendix). We do, however, detect significant differences between outcomes in the Control and Cognitive Dissonance groups within the main and postgraduate samples, which indicate opposing reactions from these stratified groups. To reduce variation and increase power, we additionally investigate treatment effects using logistic regression analysis controlling for a number of observables in our data. Our intent-to-treat analysis considers a binary response variable; therefore, we report the results of a logistic regression specification (in terms of both odds ratios and average marginal effects⁹). The logistic regression performed is specified as follows:

⁸We additionally test for balance within the subsample of Doctors and Professors in Table 2b. We find slight imbalance on energy consumption between the cognitive dissonance groups (with and without images; $p<0.10$) and imbalance between the control and cognitive dissonance groups in the number of days they have been customers of Good Energy ($p<0.05$). We provide regression results with controls—including energy consumption—though the number of days a customer has been with Good Energy has no predictive power in the model.

⁹Intuitively, the average marginal effects signify the average change in the dependent variable if we consider a marginal increase in the respective independent variable for each individual in the sample separately, then take the average of this marginal effect for all subjects in the sample.

$$\text{logit}_i = \alpha + \beta_j T_{i,j} + \gamma X_i$$

where β_j represents the effect of treatment $j \in \{1, 2, 3, \dots, 7\}$ on individual i , and γ represents the effects of a vector of control regressors.

Running the above specification, we find that receiving the cognitive dissonance message (without image) multiplies the odds that one signs up to online billing by $\exp(0.105) = 1.107$, i.e., increases the odds by 10.7% (or about an average 1.2 percentage points increase in uptake¹⁰), controlling for consumption, tariff type, and gender ($p < 0.10$). However, including the image appears to distract from the dissonance-inducing messaging, eliminating the effect altogether (consistent with the the t-tests above). While the odds of sign-up also tend to increase for the treatment groups containing environmental information, we do not have sufficient power to detect such an effect with statistical significance. Contrary to findings in the literature regarding environmental behavior and gender (see [Cheng et al., 2011](#), for a review), we find that being female decreases the odds of signing up to paperless billing by 26.5%. As shown in [Table A2](#), this result holds if we run the regression without treatment indicators within the control group alone (26.5% reduction in the odds of sign-up, $p < 0.01$); there are no significant interaction effects between gender and treatment.

Additionally, it appears that those with smaller observed environmental footprints are more likely to sign up to online billing. For instance, relative to those on dual fuel renewable tariffs, the odds of signing up among customers on either gas- or electricity-only tariffs are approximately 40% and 43% lower ($p < 0.01$). Finally, for every increase of 1000 kWh in estimated annual gas and electricity consumption, the odds of sign-up decrease by 0.004% ($p < 0.10$) and 0.014% ($p < 0.01$), respectively. If we assume that being a dual fuel consumer is indicative of higher environmental preferences than being a single fuel consumer, and that lower consumption is associated with higher

¹⁰In other words, if we consider the effect of the cognitive dissonance treatment for each individual in the sample separately—holding constant all other characteristics of that individual—and then take the mean of these marginal effects across all individuals in the sample, we see that the average marginal effect is to increase online billing uptake by 1.2 percentage points.

environmental preferences, these final two results appear to imply that individuals with stronger preferences for the environment are more likely to sign up for paperless billing.¹¹

4.2. Treatment effect heterogeneity

Since we do not have gender data for the 1844 individuals identified with the title of either “Doctor” or “Professor”, we run the logistic regression for the two samples independently. That is, in the absence of an all-inclusive continuous or categorical measure for education, we run the same regression as in Table 3 exclusively for the “postgraduate education” sample (see Table 4). Contrary to the main sample, the cognitive dissonance intervention quite drastically backfires when we consider Doctors and Professors only, decreasing the odds of sign-up by 43.0%. Again, provision of statistics on associated environmental damage does not significantly affect the odds of paperless take-up. Consumption does not predict behavior among this subsample, while again being a dual fuel customer improves the probability that the individual will sign up quite substantially ($\beta=-0.081$ relative to gas only households, $p<0.01$; $\beta=-0.054$ relative to electric only households, $p<0.05$).

If we instead run a logistic regression on the full sample that includes interaction terms between assigned treatment and a dummy indicating whether the individual is in the postgraduate education sample, we find a similar result (Table A3). On average, having extensive postgraduate education increases the odds of signing up to online billing by 31.9% ($p=0.141$), increasing uptake by almost 2 percentage points ($p=0.025$). Without controlling for gender, the odds of signing up to online billing in the cognitive dissonance (without image) treatment increase by 10.7% ($p=0.096$) in the main sample, while the odds decrease by 48.7% ($p=0.023$) for Doctors and Professors. Thus, we find robust evidence that cognitive dissonance indeed backfires among the highly educated, both in a regression with a stratified sample of interest and in a regression using interaction terms among the full sample, suggesting a potential role for heterogeneous treatment of individuals to maximize voluntary online billing uptake.

¹¹The data do not include household size, income, or age, so consumption may also act as a proxy for wealth, number of residents, or age (and therefore also potentially computer literacy) as opposed to environmental preference. We are unable to make this distinction using the data provided.

4.3. Controlling for multiple hypotheses

Given that we test multiple hypotheses in this study—here, that we compare more than one treatment to a control group—we use the LR chi-square test to determine whether, in the presence of multiple hypotheses, we can rule out the possibility that none of the interventions have an effect on uptake. An LR chi-square test does *not* reject the null hypothesis of no effect for the main regression specifications whose outputs are displayed in Tables 3 and 4. That is, the test discredits the finding that cognitive dissonance has any effect on behavior in either sample.

However, focusing our attention on the effects of environmental information and cognitive dissonance—i.e., in a logistic regression of uptake comparing the control group to treatment groups 3 and 7, which test our primary hypotheses—the LR test still does not reject a zero effect of the treatments compared to the control group for the main sample ($p=0.206$), while it does reject a zero effect of the treatments for the postgraduate education sample ($p=0.056$). These tests call for caution in interpreting the above results, and emphasize the benefits of pre-registering analyses.¹² Regardless, the results *indicate* at worst and *demonstrate* at best that there is likely an effect of dissonance-inducing messaging on individuals’ behavior in the context under investigation.

5. Discussion

In line with the literature, the results of the experiment indicate that environmental information and imagery do not affect individuals’ propensity to opt into receiving paperless communications, even among purportedly green consumers. However, appealing to customers’ desire for consistency of self-concept appears to hold promise, though doing so backfires among the subsample with doctoral-level educations. Furthermore, our findings contradict the general conclusion in the literature that females are more likely

¹²The goal of the study from an academic perspective was primarily to test the effects of environmental information and cognitive dissonance on uptake. The inclusion of imagery in the experimental design was a recommendation by the practitioners to test a commonly used internal marketing strategy. A pre-registry would have prompted us to lay out clearly our primary research questions of interest and designated all other hypotheses as “exploratory analysis” to be excluded from the multiple hypothesis testing and main conclusions, and to be included as additional analysis to inform future research.

to engage in environmental behaviors than males. The results indicate that informational campaigns are likely ineffective in promoting environmental behaviors, and that individuals with revealed altruistic preferences toward the environment may be susceptible to messaging invoking feelings of cognitive dissonance.

Given that the information provided is both easily available and free to access, the null effect of environmental information speaks to many existing and emerging strands of literature on information and behavior and holds a number of possible explanations. For example, the results fall in line with the notion of information avoidance, where individuals actively choose to evade information that might make them engage in altruistic behaviors that they otherwise do not wish to perform (Cain and Dana, 2012; Golman et al., 2015). A second explanation stemming from a phenomenon called moral licensing suggests that individuals who “do good” along one dimension may allow themselves to “do bad” (or simply not “do good”) along another (see Merritt et al., 2010). Alternatively, perhaps the information is sufficient to change beliefs and intentions (as claimed in Abrahamse et al., 2005), though intentions have proven to be poorly correlated with behavior change (Webb and Sheeran, 2006). Another possible explanation is that Good Energy customers are already well aware of such information so that additional information has little effect on their beliefs, in line with a diminishing returns argument (Stern, 2000). Given that the information was framed as an outcome of the actions of many customers, low expectations of others’ cooperation may also have diminished the effectiveness of the information in this context, in line with research on conditional cooperation (e.g., Chaudhuri, 2011; Frey and Meier, 2004). Finally, it may be the case that the external costs are simply not sufficiently severe to induce change, or that individuals do not perceive their role in the problem as relevant (Biel and Thøgersen, 2007).

Moreover, the experimental results suggest that particular individuals may be more or less susceptible to certain behavioral anomalies. In our case, individuals titled “Doctor” or “Professor” are less likely to opt into online billing if they receive the dissonance-inducing intervention as opposed to the control intervention. One possible explanation is that individuals in the post-graduate sample have higher cognitive skills, and that such cognitive skills play a role in determining levels of experienced dissonance in the same way they have been experimentally demonstrated to determine risk preferences and impatience (Dohmen et al., 2010). A second explanation rests in line

with the theory of [Akerlof and Dickens \(1982\)](#) in the sense that selection into a green utility provider will solidify conviction of one's own environmental consciousness and will justify receipt of paper billing; when paperless billing is subsequently offered in the second period, the individual has altered her attitude toward the environmental harm of paper billing.

In sum, this research suggests that green businesses should consider abandoning the use of information regarding environmental externalities as a tool to encourage environmentally beneficial decision making, especially since shifting perceived responsibility for social outcomes from governments or organizations to consumers may impose welfare costs ([Bruvoll and Nyborg, 2004](#)). Rather, they may appeal to their customer bases using more subtle tactics rooted in the psychology of cognitive dissonance, with careful attention to the audience of the messaging. Indeed, there are many additional strategies that could be equally—or possibly more—effective in encouraging particular types of customers to continue to make decisions in line with their past behaviors. This particular strategy may well generalize to other groups of socially responsible consumers, such as donors to particular causes or voters who have historically engaged in altruistic or civic behaviors. Further research should aim to gain a more nuanced understanding of the types of individuals who may or may not be responsive to messaging that appeals to desires for consistency in the self-concept in order to elucidate the underlying drivers behind the heterogeneity of outcomes observed in this study.

Acknowledgments

Sincere thanks to Juliet Davenport, Will Vooght, and Dave Ford for the time and effort they put forth in the implementation of this study. Thanks also to Robert Metcalfe for his valuable input into the study design, and to Daan van Soest, Ganga Shreedhar, Alessandro Tavoni, and participants at the 2017 International Meeting on Experimental and Behavioural Social Sciences and the 2018 World Congress of Environmental and Resource Economists for providing insightful and constructive feedback. This work was supported by the Grantham Foundation for the Protection of the Envi-

ronment and the ESRC Centre for Climate Change Economics and Policy. Neither were involved in the study design, implementation, analysis, or interpretation. All views expressed in this paper are solely attributable to the author.

Conflicts of interest: None. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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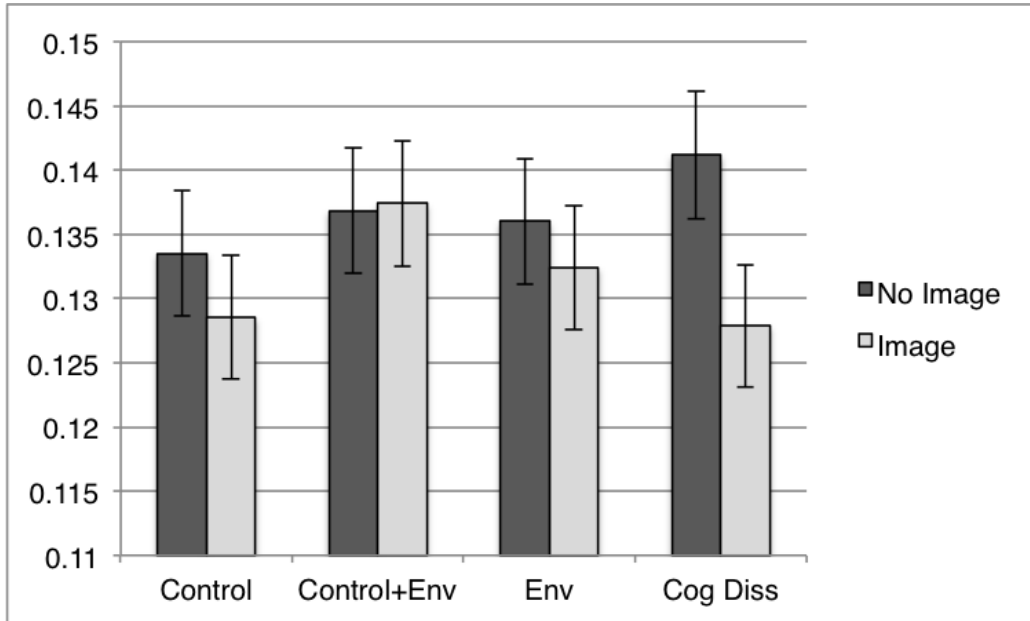
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Figure 1: Online billing Uptake According to Group Assignment



Notes: The above bar graph shows the proportion of each study group that signed up to online billing, with standard error bars.

6. Figures and Tables

Table 1: Treatment Group Design

Content	<i>Control</i>	<i>Environmental Framing</i>	<i>Control + Environmental Framing</i>	<i>Cognitive Dissonance</i>
Availability and Online Access	✓	✓	✓	✓
Customer Benefits	✓		✓	✓
Environmental Benefits		✓	✓	
Environmental Steward				✓

Notes: While the *Control and Environmental Framing* intervention simply adds environmental information to the *Control* email, the email doubles in length with the addition. Therefore, we also include the *Environmental Framing* intervention that is a similar length and format to the *Control* email so that we can ‘control’ for the added complexity of including a large amount of additional information to the *Control* email. All even-numbered groups receive the treatment with the image.

Table 2a: Balance Check: Full Sample

	Image vs. No Image											Control vs. Treatments						
	Group 1	Group 2	Test: 1=2	Group 3	Group 4	Test: 3=4	Group 5	Group 6	Test: 5=6	Group 7	Group 8	Test: 7=8	Test: 1=3	Test: 1=4	Test: 1=5	Test: 1=6	Test: 1=7	Test: 1=8
<i>Fuel Type:</i>																		
Dual Fuel	0.409 (0.492)	0.411 (0.492)	p=0.824	0.410 (0.492)	0.409 (0.492)	p=0.930	0.408 (0.491)	0.407 (0.491)	p=0.991	0.409 (0.492)	0.409 (0.492)	p=0.975	p=0.923	p=0.993	p=0.886	p=0.877	p=0.998	p=0.971
Gas	0.062 (0.241)	0.062 (0.241)	p=0.949	0.063 (0.243)	0.061 (0.239)	p=0.628	0.062 (0.241)	0.062 (0.241)	p=0.967	0.062 (0.242)	0.062 (0.241)	p=0.943	p=0.762	p=0.856	p=0.934	p=0.968	p=0.947	p=0.972
Electricity	0.529 (0.499)	0.527 (0.499)	p=0.803	0.527 (0.499)	0.53 (0.499)	p=0.748	0.530 (0.499)	0.531 (0.499)	p=0.975	0.529 (0.499)	0.530 (0.499)	p=0.948	p=0.809	p=0.937	p=0.919	p=0.894	p=0.972	p=0.985
Gas Consumption	13.949 (9.352)	13.807 (9.025)	p=0.602	13.863 (9.038)	13.605 (8.590)	p=0.324	13.633 (8.757)	13.781 (9.092)	p=0.575	13.886 (9.284)	13.672 (8.864)	p=0.426	p=0.751	p=0.197	p=0.240	p=0.540	p=0.819	p=0.305
Electricity Consumption	3.720 (3.845)	3.622 (3.231)	p=0.190	3.753 (4.162)	3.626 (3.283)	p=0.107	3.625 (3.419)	3.672 (3.671)	p=0.531	3.685 (3.419)	3.640 (3.615)	p=0.548	p=0.700	p=0.208	p=0.214	p=0.540	p=0.645	p=0.310
Days as Customer	314.8 (333.9)	313.9 (321.0)	p=0.887	312.1 (327.5)	313.3 (333.8)	p=0.861	317.4 (338.3)	317.2 (344.0)	p=0.977	316.7 (342.4)	318.8 (346.7)	p=0.770	p=0.681	p=0.815	p=0.709	p=0.733	p=0.787	p=0.573
Gender	0.469 (0.499)	0.468 (0.499)	p=0.952	0.470 (0.499)	0.471 (0.499)	p=0.907	0.470 (0.499)	0.470 (0.499)	p=0.991	0.469 (0.499)	0.472 (0.499)	p=0.677	p=0.937	p=0.845	p=0.897	p=0.906	p=0.949	p=0.792
Postgraduate Education	0.045 (0.208)	0.046 (0.210)	p=0.860	0.050 (0.217)	0.051 (0.219)	p=0.830	0.048 (0.213)	0.051 (0.220)	p=0.446	0.046 (0.210)	0.045 (0.207)	p=0.677	p=0.330	p=0.234	p=0.622	p=0.210	p=0.820	p=0.850
Sample Size	4817	4825		4834	4850		4830	4838		4825	4836							

Notes: The p-values in the table derive from chi-square tests for comparisons of dummy and categorical variables and t-tests for comparisons of continuous variables. Group 1 (2) is the Control group (with image), 3 (4) is the Control and Environmental Framing (with image), 5 (6) is Environmental Framing (with image), 7 (8) is Cognitive Dissonance (with image). The table pertains to individuals in the entire sample, except for the following: gender balance tests are conducted only for individuals for whom gender is identified, and balance tests on annual gas and electricity consumption are conducted only for individuals who consume gas and energy, respectively. The fuel type dummy variables specify the type of fuel the customer receives from Good Energy, where “dual fuel” indicates that the household receives both gas and electricity. Gas and electricity consumption represent estimated annual usage values measured at the unit of 1000 kWh. Standard deviations are reported below means in parentheses.

Table 2b: Balance Check: Postgraduate Sample

	Image vs. No Image											Control vs. Treatments						
	Group 1	Group 2	Test: 1=2	Group 3	Group 4	Test: 3=4	Group 5	Group 6	Test: 5=6	Group 7	Group 8	Test: 7=8	Test: 1=3	Test: 1=4	Test: 1=5	Test: 1=6	Test: 1=7	Test: 1=8
<i>Fuel Type:</i>																		
Dual Fuel	0.388 (0.488)	0.422 (0.495)	p=0.475	0.413 (0.493)	0.400 (0.490)	p=0.710	0.391 (0.489)	0.385 (0.487)	p=0.881	0.433 (0.497)	0.449 (0.499)	p=0.735	p=0.595	p=0.864	p=0.945	p=0.938	p=0.337	p=0.198
Gas	0.064 (0.245)	0.067 (0.251)	p=0.887	0.083 (0.277)	0.090 (0.286)	p=0.800	0.074 (0.262)	0.077 (0.267)	p=0.901	0.058 (0.234)	0.056 (0.230)	p=0.911	p=0.428	p=0.298	p=0.677	p=0.585	p=0.796	p=0.713
Electricity	0.548 (0.499)	0.511 (0.500)	p=0.439	0.504 (0.501)	0.514 (0.501)	p=0.824	0.535 (0.500)	0.538 (0.500)	p=0.936	0.509 (0.501)	0.495 (0.501)	p=0.776	p=0.348	p=0.468	p=0.780	p=0.837	p=0.411	p=0.272
Gas Consumption	16.736 (9.921)	15.542 (10.777)	p=0.409	15.829 (10.942)	16.178 (10.988)	p=0.806	15.463 (9.509)	15.479 (9.998)	p=0.991	16.257 (9.861)	14.977 (9.006)	p=0.317	p=0.526	p=0.697	p=0.348	p=0.359	p=0.728	p=0.182
Electricity Consumption	3.898 (3.134)	3.766 (3.208)	p=0.672	3.827 (3.434)	3.627 (2.748)	p=0.498	3.673 (2.965)	3.840 (3.138)	p=0.567	4.422 (5.937)	3.499 (4.169)	p=0.068	p=0.825	p=0.342	p=0.452	p=0.849	p=0.262	p=0.275
Days as Customer	341.2 (427.5)	354.4 (396.7)	p=0.737	303.3 (241.3)	308.0 (289.6)	p=0.848	311.9 (321.2)	352.2 (451.5)	p=0.265	282.3 (81.1)	302.6 (182.1)	p=0.130	p=0.238	p=0.411	p=0.788	p=0.323	p=0.044	p=0.222
Sample Size	219	223		240	245		230	247		224	216							

Notes: The p-values in the table derive from chi-square tests for comparisons of dummy and categorical variables and t-tests for comparisons of continuous variables. Group 1 (2) is the Control group (with image), 3 (4) is the Control and Environmental Framing (with image), 5 (6) is Environmental Framing (with image), 7 (8) is Cognitive Dissonance (with image). Balance tests on annual gas and electricity consumption are conducted only for individuals who consume gas and energy, respectively. Annual estimated energy and gas consumption are measured at the unit of 1000 kWh. The fuel type dummy variables specify the type of fuel the customer receives from Good Energy, where “dual fuel” indicates that they receive both gas and electricity. Gas and electricity consumption are estimated annual usage values measured at the unit of 1000 kWh. Standard deviations are reported below means in parentheses.

Table 3: Logit Regression — Main Sample

	OR	Marginal	OR	Marginal
G2: Control, Image	0.971 (0.060)	-0.003 (0.007)	0.968 (0.060)	-0.004 (0.007)
G3: Env	1.017 (0.062)	0.002 (0.007)	1.018 (0.063)	0.002 (0.007)
G4: Env, Image	0.997 (0.061)	-0.000 (0.007)	0.996 (0.062)	-0.000 (0.007)
G5: Control Env	1.042 (0.064)	0.005 (0.007)	1.042 (0.064)	0.005 (0.007)
G6: Control Env, Image	1.046 (0.064)	0.005 (0.007)	1.047 (0.064)	0.005 (0.007)
G7: Cog Diss	1.105* (0.067)	0.012* (0.007)	1.107* (0.067)	0.012* (0.007)
G8: Cog Diss, Image	0.964 (0.06)	-0.004 (0.007)	0.965 (0.06)	-0.004 (0.007)
Gas Consumption			0.996* (0.002)	-0.001* (0.000)
Energy Consumption			0.986*** (0.005)	-0.002*** (0.001)
Tariff: Gas Only			0.597*** (0.043)	-0.050*** (0.006)
Tariff: Electric Only			0.569*** (0.026)	-0.065*** (0.005)
Female			0.735*** (0.023)	-0.035*** (0.004)
Constant	0.152*** (0.007)		0.257*** (0.015)	
<i>Observations</i>	36,810	36,810	36,810	36,810
<i>Controls</i>	No	No	Yes	Yes

Notes: The above logit regression pertains to individuals in the main sample. Annual estimated energy and gas consumption are measured at the unit of 1000 kWh.

Table 4: Logit Regression — Postgraduate Education Sample

	OR	Marginal	OR	Marginal
G2: Control, Image	0.946 (0.245)	-0.007 (0.032)	0.929 (0.242)	-0.009 (0.032)
G3: Env	1.110 (0.275)	0.014 (0.034)	1.10 (0.274)	0.012 (0.033)
G4: Env, Image	0.992 (0.249)	-0.001 (0.032)	0.986 (0.249)	-0.002 (0.032)
G5: Control Env	0.943 (0.243)	-0.007 (0.032)	0.936 (0.242)	-0.008 (0.032)
G6: Control Env, Image	0.867 (0.222)	-0.018 (0.031)	0.869 (0.224)	-0.017 (0.031)
G7: Cog Diss	0.582* (0.166)	-0.060** (0.027)	0.570* (0.164)	-0.062** (0.027)
G8: Cog Diss, Image	0.917 (0.241)	-0.011 (0.032)	0.876 (0.232)	-0.016 (0.032)
Gas Consumption			1.001 (0.009)	0.000 (0.001)
Energy Consumption			0.969 (0.024)	-0.004 (0.003)
Tariff: Gas Only			0.446*** (0.137)	-0.081*** (0.024)
Tariff: Electric Only			0.655** (0.132)	-0.054** (0.026)
Constant	0.197*** (0.036)		0.285*** (0.070)	
<i>Observations</i>	1844	1844	1844	1844
<i>Controls</i>	No	No	Yes	Yes

Notes: The above logit regression pertains to individuals in the main sample. Annual estimated energy and gas consumption are measured at the unit of 1000 kWh.

Appendix

Additional Tables and Figures

Table A1: Proportion Signed up to Online Billing: Chi-Square Tests Comparing Experimental Conditions

	Control (C)	Environmental Framing (EF)	Test of Equality: C vs. EF	Control and Environmental Framing (CEF)	Test of Equality: C vs. CEF	Test of Equality EF vs. CEF	Cognitive Dissonance (CD)	Test of Equality C vs. CD
<i>Full Sample:</i>								
No Image	0.134 (0.340) N=4817	0.136 (0.343) N=4830	p=0.693	0.138 (0.345) N=4834	p=0.539	p=0.826	0.142 (0.349) N=4824	p=0.226
Image	0.130 (0.337) N=4825	0.134 (0.340) N=4838	p=0.624	0.138 (0.345) N=4850	p=0.261	p=0.526	0.129 (0.335) N=4836	p=0.893
Pooled	0.132 (0.338) N=9642	0.135 (0.342) N=9668	p=0.532	0.138 (0.345) N=9684	p=0.219	p=0.546	0.136 (0.343) N=9660	p=0.439
<i>Main Sample:</i>								
No Image	0.132 (0.339) N=4598	0.134 (0.341) N=4590	p=0.781	0.137 (0.344) N=4604	p=0.498	p=0.690	0.144 (0.351) N=4600	p=0.098
Image	0.129 (0.335) N=4602	0.132 (0.338) N=4593	p=0.661	0.138 (0.344) N=4603	p=0.221	p=0.433	0.128 (0.334) N=4620	p=0.918
Pooled	0.131 (0.337) N=9200	0.133 (0.340) N=9183	p=0.612	0.137 (0.344) N=9207	p=0.179	p=0.403	0.136 (0.343) N=9220	p=0.398
<i>Postgraduate Sample:</i>								
No Image	0.164 (0.371) N=219	0.179 (0.384) N=240	p=0.675	0.157 (0.364) N=230	p=0.820	p=0.512	0.103 (0.304) N=224	p=0.056
Image	0.157 (0.365) N=223	0.163 (0.370) N=245	p=0.852	0.146 (0.354) N=247	p=0.735	p=0.591	0.153 (0.361) N=216	p=0.904
Pooled	0.161 (0.368) N=442	0.171 (0.377) N=485	p=0.668	0.151 (0.358) N=477	p=0.686	p=0.394	0.127 (0.334) N=440	p=0.778

Notes: The table shows the results of tests of equality of proportion of individuals who sign up across experimental conditions for all subjects in the study sample, where groups with and without images (e.g., G1 and G2) are pooled in the final row. Standard deviations are presented below means in parentheses.

Table A2: Effects of Observed Covariates — Control Group Only

	OR	Marginal
Electricity Consumption	0.993 (0.007)	-0.001 (0.001)
Gas Consumption	0.985 (0.014)	-0.002 (0.002)
Tariff: Gas Only	0.581*** (0.118)	-0.052*** (0.016)
Tariff: Electricity Only	0.530*** (0.069)	-0.073*** (0.015)
Female	0.735*** (0.065)	-0.036*** (0.010)
Constant	0.272*** (0.032)	
<i>Observations</i>	4598	4598

Notes: The above logit regression pertains to the individuals in the control group (without image) of the main sample. Annual estimated energy and gas consumption are measured at the unit of 1000 kWh.

Table A3: Postgraduate Education and Treatment

	OR	Marginal
G2: Control, Image	0.969 (0.060)	-0.004 (0.007)
G3: Env	1.018 (0.063)	0.003 (0.007)
G4: Env, Image	0.996 (0.062)	-0.001 (0.007)
G5: Control Env	1.042 (0.064)	0.004 (0.007)
G6: Control Env, Image	1.047 (0.064)	0.004 (0.007)
G7: Cog Diss	1.107* (0.067)	0.008 (0.007)
G8: Cog Diss, Image	0.965 (0.060)	-0.005 (0.007)
G2*Educ	0.956 (0.256)	
G3*Educ	0.898 (0.238)	
G4*Educ	0.826 (0.219)	
G5*Educ	1.074 (0.276)	
G6*Educ	0.987 (0.256)	
G7*Educ	0.513** (0.150)	
G8*Educ	0.912 (0.247)	
Gas Consumption	0.996 (0.002)	-0.000 (0.000)
Energy Consumption	0.987*** (0.005)	-0.002*** (0.001)
Tariff: Gas Only	0.605*** (0.042)	-0.050*** (0.006)
Tariff: Electric Only	0.581*** (0.026)	-0.063*** (0.005)
Educ	1.319 (0.248)	0.019** (0.009)
Constant	0.220*** (0.012)	
<i>Observations</i>	38,654	38,654

Notes: The above logit regression includes all individuals in the study sample. Annual estimated energy and gas consumption are measured at the unit of 1000 kWh.

Figure A1: Control Intervention

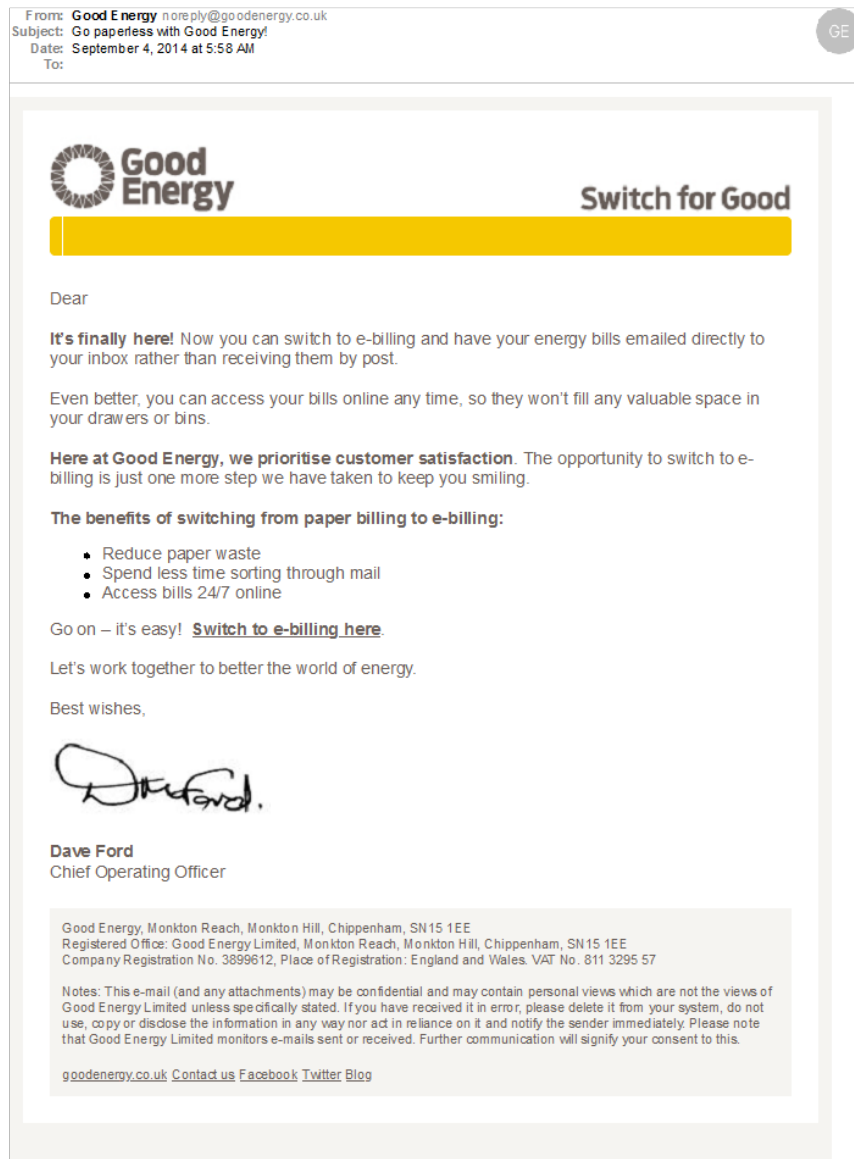


Figure A2: Environmental Framing Intervention

From: **Good Energy** noreply@goodenergy.co.uk
Subject: **Go paperless with Good Energy!**
Date: **September 4, 2014 at 7:55 AM**
To:

GE

 **Good Energy** **Switch for Good**

Dear

It's finally here! Now you can switch to e-billing and have your energy bills emailed directly to your inbox rather than receiving them by post.

If all of our customers make the switch, we would save 46 trees worth of paper each year!*

Even better, you can access your bills online any time, so they won't fill any valuable space in your drawers or bins.

Here at Good Energy, we prioritise customer satisfaction as well as the environment. The opportunity to switch to e-billing is just one more step we have taken to keep you smiling and help you shrink your environmental footprint.

Why reduce paper waste?

- The average UK family throws away 6 trees worth of paper in their household bin each year.
- Paper production ranks 3rd and 4th for most energy intensive and greenhouse gas intensive manufacturing industries (respectively).
- 12.5 million tonnes of paper and cardboard are used annually in the UK, making us the 11th worst paper offender in the world.

Go on – it's easy! [Switch to e-billing here](#)

Let's work together to better the world of energy.

Best wishes,



Dave Ford
Chief Operating Officer


** Note: This calculation is based on 8333 sheets per tree and 64,000 two-page bills, which we send to our customers each quarter.*

Good Energy, Monkton Reach, Monkton Hill, Chippenham, SN15 1EE
Registered Office: Good Energy Limited, Monkton Reach, Monkton Hill, Chippenham, SN15 1EE
Company Registration No. 3899612, Place of Registration: England and Wales. VAT No. 811 3295 57

Figure A3: Control and Environmental Framing Intervention

From: **Good Energy** noreply@goodenergy.co.uk
Subject: **Go paperless with Good Energy!**
Date: **September 4, 2014 at 7:41 AM**
To:

GE

 **Good Energy** **Switch for Good**

Dear

It's finally here! Now you can switch to e-billing and have your energy bills emailed directly to your inbox rather than receiving them by post.

If all of our customers make the switch, we would save 46 trees worth of paper each year!*

Even better, you can access your bills online any time, so they won't fill any valuable space in your drawers or bins.

Here at Good Energy, we prioritise customer satisfaction as well as the environment. The opportunity to switch to e-billing is just one more step we have taken to keep you smiling and help you shrink your environmental footprint.

The benefits of switching from paper billing to e-billing:

- Reduce paper waste
- Spend less time sorting through mail
- Access bills 24/7 online


Why reduce paper waste?

- The average UK family throws away 6 trees worth of paper in their household bin each year.
- Paper production ranks 3rd and 4th for most energy intensive and greenhouse gas intensive manufacturing industries (respectively).
- 12.5 million tonnes of paper and cardboard are used annually in the UK, making us the 11th worst paper offender in the world.

Go on – it's easy! [Switch to e-billing here](#)

Let's work together to better the world of energy.

Best wishes,



Dave Ford
Chief Operating Officer

* Note: This calculation is based on 8333 sheets per tree and 64,000 two-page bills, which we send to our customers each quarter.

Figure A4: Cognitive Dissonance Intervention

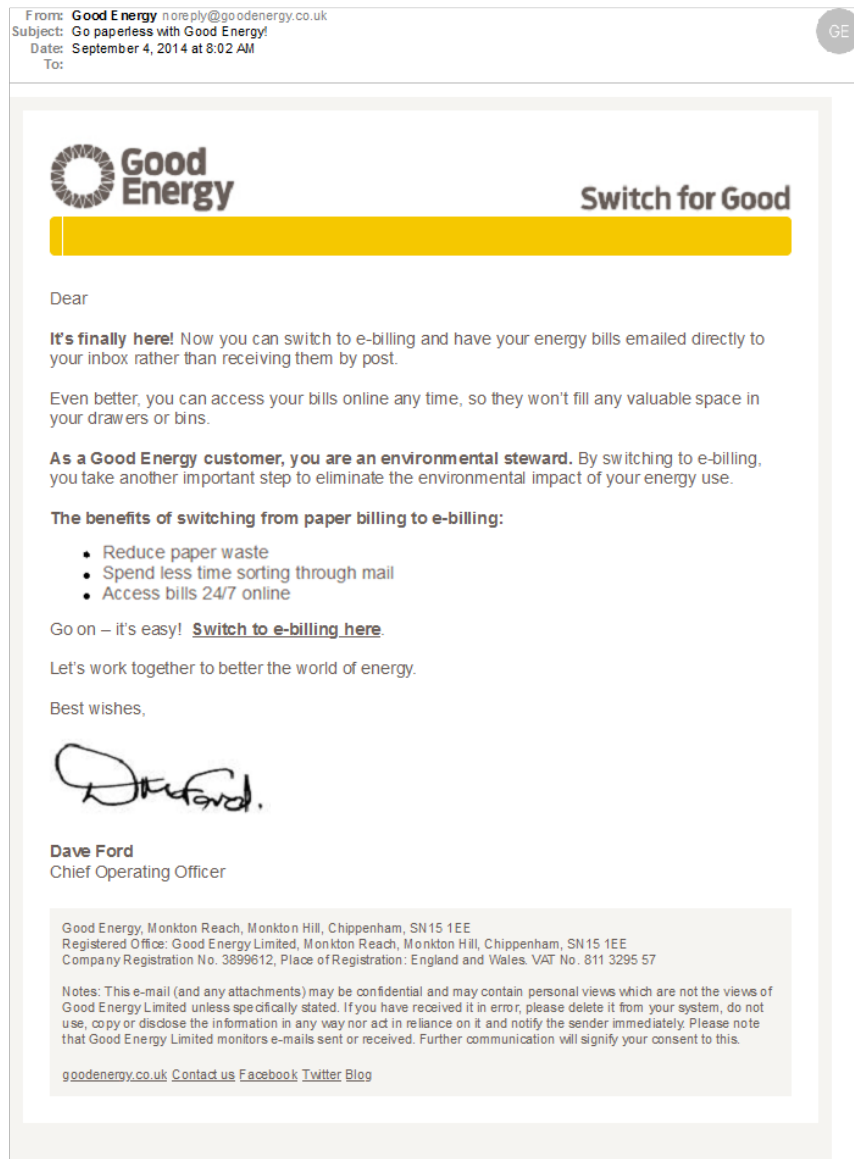


Figure A5: Email Image



Switch for Good

