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**The Introduction of a Single-Use Carrier Bag Charge
in Wales: Attitude Change and Behavioural Spillover
Effects**

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Abstract

Wales is the first country in the United Kingdom to have introduced a charge for single-use carrier bags. From the 1st of October 2011 shoppers in Wales have to pay a compulsory five pence for each single-use carrier bag at point of sale. A controlled field experiment, comparing Welsh and English samples, was set up to evaluate the effectiveness and further attitudinal and behavioural impacts of the charge. The introduction of the carrier bag charge was used to examine whether environmental policies may become more popular after their introduction and could lead to behaviour spillover (i.e., when adoption of one behaviour leads to the adoption of another behaviour). The study found that the charge was highly effective in changing its target behaviour. While own bag use increased in both countries, the increase was much greater in Wales than in England. The study also found evidence for the policy becoming more popular after its implementation. Despite support for the carrier bag charge already being high before its introduction, the Welsh population became even more supportive afterwards. Although no support was found for positive behavioural spillover, the study found changes in environmental identity that could produce spillover effects in the longer term. The theoretical and policy implications of the findings are discussed.

Key Words: Single-Use Carrier Bags; Behaviour Change Intervention; Attitude Change
Environmental Identity; Behavioural Spillover

Acknowledgments

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Introduction

Wales is the first country in the United Kingdom to have introduced a charge for single-use carrier bags. From the 1st of October 2011 onwards, shoppers in Wales have to pay a compulsory five pence for each single-use carrier bag at point of sale. The charge was introduced to prevent litter and to minimise the amount of waste going to landfill (Welsh Assembly Government, 2010). A study was set up to evaluate the effectiveness of the charge to reduce carrier bag use amongst the general public, and to explore further attitudinal and behavioural responses to the charge. More specifically, the introduction of the carrier bag charge was used to examine whether environmental policies may become more popular among the public after their introduction and lead to ‘behaviour spillover’, i.e. may promote environmental behaviours other than the one(s) directly targeted by the policy.

Over the past decade a remarkable shift in the international norms associated with disposable carrier bags has taken place. Single-use carrier bags – plastic ones in particular – are increasingly seen as an environmental hazard that threaten human and animal welfare, rather than as a benign modern convenience (Clapp & Swanston, 2009). Many national and local governments have either banned or put a restriction on the sale or use of disposable plastic bags. Measures to reduce the use of plastic bags are one of the few examples of environmental policy that emerged in the geographical south and later migrated to the geographical north. Early campaigns against plastic bags started in the mid-1990s in South Asia (Bangladesh and a number of Indian states) and Taiwan. In the early 2000s, a number of African countries and Ireland introduced legislation to reduce the use of disposable plastic bags by imposing a tax on their sale. The apparent success of these countries to reduce plastic bag use among the general public has led to other countries, states and local communities in both the North and South following suit with comparable policies. A detailed account of the spread of an anti-plastic bag norm across the world is given by Clapp and Swanston (2009).

While there have been many initiatives to reduce single-use carrier bags, surprisingly little research has been conducted to evaluate the effectiveness of these policies. The evidence that is available suggests that a tax or a charge on disposable carrier bags can be highly effective.¹ A plastic bag tax that was introduced in the Republic of Ireland in 2002 (the ‘plastax’) was hailed an outstanding success. Research by Convery et al. (2007) shows that the charge reduced plastic bag use by more than 90% and raised revenues in the order of €12-14 million for the Environment Fund. However, this conclusion was based on evidence collated from a variety of sources, not on a systematic evaluation of the policy. More recently, it has been estimated that a national plastic bag charge introduced in China in 2008 led to a 49% reduction in the use of new plastic bags (He, 2010). In this research, independent samples of shoppers were interviewed before and after the implementation of the policy. However, without a comparable control group the study was not able to separate the effects from secular trends in plastic bag use.

¹ The difference between a tax or a levy and a charge is that the revenues of a tax go to the government while the revenues of a charge go to the retailer. In most retailers donate the proceeds to a charity of choice

There are different ways in which the effectiveness of a tax or a charge on carrier bags can be understood. Economists see such a tax as a typical market-based instrument that internalises the costs of environmental pollution, thereby correcting a market failure that led to the over-use of carrier bags. The effectiveness is therefore based on the pricing of the external costs of pollution that were not previously part of the consumers' decision to use disposable carrier bags. The functioning of market-based instruments is well supported by economic theory (see e.g. Tietenberg et al., 1999). According to economic theory, 'emissions' (i.e. number of bags used) will be reduced to the point where the marginal benefits of internalisation equal the marginal costs of abatement (Convery et al., 2007). However, while the pricing certainly forms part of the explanation, a singular economic focus may ignore important psychological processes that contribute to the success of a tax or charge to change behaviour. The functioning of the carrier bag charge can also be understood from a 'habit discontinuity' perspective (Verplanken et al., 2008). The use of single-use carrier bags, as many other unsustainable behaviours, may not be driven by conscious intent, but may be strongly habitual (i.e., automatic, frequent, and 'cued' by stable contexts; Verplanken et al., 1998). The wide and easy availability of single-use carrier bags at the cashier till may trigger their use and contribute to automatic habitual behaviour. The habit discontinuity hypothesis states that, as habits are 'cued' by stable contexts in which behaviour takes place, they may be changed at particular moments in time when the context changes. When the context changes, old habits are disrupted and behaviour needs to be renegotiated (Verplanken et al., 2008). The charge forces consumers to make a conscious choice as to whether they want to purchase a single-use carrier bag or not. People are then triggered to adapt their behaviour to either avoid the charge, as argued by economic theory, or to bring behaviour in line with their (environmental) values, as posited by the self-activation hypothesis (Verplanken et al., 2008). In either case, by repeating the new behaviour (i.e. bringing a reusable bag to the supermarket and other shops), it is likely to become a new habit replacing the old unsustainable one.

Attitudinal Responses to Environmental Policies

In addition to the intended changes in the targeted behaviours, environmental policies appear to elicit a number of other less well understood attitudinal and behavioural responses. Despite Irish consumers being somewhat resistant to the plastic bag charge prior to its introduction (Drury Research, 2000), Convery et al (2007) reported that they became more positive about the policy after the implementation of the charge. Convery and colleagues (2007) even label the policy the most popular tax in Europe. Similar positive attitudinal changes were observed in response to other environmental and behavioural change policies. Research on smoking bans has shown that they became more acceptable after coming into force. Smokers as well as non-smokers have been found to express more support for bans after the benefits of the ban became apparent (Borland et al., 1990; Owen et al., 1991; Seo et al., 2011). Congestion charges are considered around the world to curb urban traffic. They have proven to be highly controversial amongst the general public, in particular before their implementation, leading to many being cancelled (see e.g. Gaunt et al., 2007). However, Schuitema et al. (2010) showed that Stockholm residents thought that a

congestion charge had more positive consequences and fewer negative consequences than they had expected before it was trialled in 2006. Comparable effects were reported by Transport for London (2004). London residents perceived fewer negative effects from the congestion charge than they had expected prior to its implementation in 2003. Residents were also more likely to recognise the benefits after the introduction of the charge.

Attitude change brought about by environmental and behaviour change policies can be explained by well-established social psychological consistency theories, such as *cognitive dissonance* (Festinger, 1957) and *self-perception theory* (Bem, 1967). Cognitive dissonance theory posits that people feel discomfort if they hold conflicting attitudes and behaviour, and that they have a motivational drive to reduce such dissonance. People may do this by changing either their attitudes or their behaviours. According to self-perception theory, people infer their own attitudes from observing their own behaviour. Attitude change is therefore likely to occur if policies are successful in changing behaviour. People may then deduce that they like the policy that has brought about the change. Unfortunately, as is often the case with real-life evaluation research, none of the studies above were able to include a control group. It is therefore not clear whether the effects can be explained by consistency processes or reflect more general attitudinal trends caused by other external factors.

Nonetheless, these findings appear to challenge the assumption in environmental psychology that positive public attitudes leads to the acceptance and effectiveness of behaviour change policies (Spence & Pidgeon, 2009). Rather it seems that the public may develop more positive attitudes *after* they have experienced the benefits of the policy and/or have changed their behaviour. Crucially though, all policies reported here (the Irish 'plastax', the Stockholm and London congestion charges, and various smoking bans) had considerable levels of public support before they were introduced, despite vocal resistance from opponents. It is possible that a shift towards more positive attitudes may only occur if the policy already has a minimum level of support, is easily adapted to, and has clear benefits. As the Welsh single-use carrier bag charge appears to fulfil all these criteria, it is likely that the policy will become (even) more popular after its introduction.

Behavioural Responses to Environmental Policies: Spillover Effects

A possible side effect of cognitive dissonance and self-perception processes may be that the policies and their accompanying attitude and behaviour changes may lead to *behavioural spillover* – the idea that engagement in a single pro-environmental behaviour may lead to further lifestyle changes (Thøgersen, 2004; Thøgersen & Crompton, 2009). According to Bem's self-perception theory (1967) people do not only infer their attitudes from their behaviours, they also use their behaviours as 'cues to their internal dispositions'. This means that engagement in pro-environmental behaviour may encourage changes in people's environmental values and identity, which then may lead to further behavioural changes in line with their revised identity (Whitmarsh & O'Neill, 2010). That is, if people stop using single-use carrier bags and start bringing their own reusable bag to the shops, they may see themselves as more waste conscious, which then may lead to other waste-conscious decisions and behaviours.

The idea of behavioural spillover has gained some support as a novel way to promote sustainable lifestyles change. It is hoped that certain 'catalytic' or 'wedge' behaviours may serve as entry points in helping different groups to make other changes (Defra, 2008). However, there is still relatively limited empirical support for such spillover effects, with most evidence being only correlational. Recent cross-sectional studies have identified clusters of similar 'types' of behaviour, suggesting that environmental behaviours often are not performed in isolation but tend to co-exist (Barr et al., 2005; Whitmarsh & O'Neill, 2010). While spillover may have contributed to the development of these behavioural clusters, no causal link can be established between the behaviours. Similarly, Thøgersen and Noblet (in press) report a positive association between 'everyday green consumer behaviour' and acceptance of wind power in their area. Research by Poortinga et al. (2012) indicates that this association is mainly due to people's personal norms and environmental identity, suggesting that these factors play a central role in behavioural spillover. The only experimental evidence that shows the potential for positive behavioural spillover comes from a study conducted by Evans et al (2012). They found that recycling was significantly higher when participants had previously received environmental information about car sharing. No significant effect was found when participants received financial information about car sharing. This study may suggest that positive spillover may only occur if the right environmental values are primed.

There is a major risk in relying on behavioural spillover to establish wide-ranging lifestyle changes. There have been suggestions that in certain cases adopting particular pro-environmental behaviours may establish 'moral credentials' (Thøgersen & Crompton, 2009) leading to so-called *negative spillover* or a '*licensing effect*' (Mazar & Zhong, 2009). By engaging in one salient environmentally significant act (e.g., recycling), people may feel that they have earned the right to engage in other unsustainable behaviours (e.g., a flight to an exotic destination). It is therefore possible that attempts to change single behaviours may in fact lead to less sustainable lifestyles.

Aim of the Research

The overall aim of the study is to investigate the effectiveness of and behavioural and attitudinal responses to the single-use carrier bag charge in Wales. The focus of the research is threefold. First, the study will examine the effectiveness of the charge to reduce its target behaviour of single-use carrier bag use. It is expected that people are more likely to bring their own reusable shopping bag/s to supermarkets and other shops after the introduction of the charge. Second, the study will examine attitudinal changes brought about by the charge. It is expected that due to self-perception and cognitive dissonance processes, people will become more positive about the carrier bag charge after its introduction. Because more people will bring their own reusable bag after the introduction of the carrier bag charge, a waste-conscious/environmental identity will become more prevalent. This will be accompanied by more positive attitudes to the charge in order to reduce potential attitude-behaviour conflicts. The third aim of the paper is to explore behavioural spillover effects of the carrier bag charge. More specifically, it is examined whether the charge has the potential

to promote the adoption of environmental behaviours other than the one(s) directly targeted by the charge. It is expected that the carrier bag charge will lead to changes in other waste-related behaviours (e.g. recycling) but not in non-waste related environmental behaviours (e.g. energy use) due to greater consistency in behaviour occurring within similar behavioural clusters.

Method

The Study

A controlled field experiment consisting of independent samples was set up to evaluate the introduction of the single-use carrier bag charge in Wales. Telephone surveys were conducted in Wales before (n=500) and after (n=500) the introduction of the charge. Similar telephone surveys were conducted in England at the same times (n=500 in both the before and after samples). The interviews conducted in England, where no carrier bag charge was introduced, served as the control for the study. The 'before' telephone interviews were conducted from 19 to 30 September 2011 in Wales (the two weeks prior to the introduction of the charge) and from 19 September to 8 October 2011 in England. The 'after' telephone interviews were conducted from 8th April to 1st May 2012. A quota sampling strategy was used to obtain representative samples. Broad quotas were set for gender, age and urban-rural location. The independent samples were then weighted to the known socio-demographic profile of the Welsh and English populations as recorded in the 2001 Census. The 'before' and 'after' Welsh and English samples were therefore comparable in terms of socio-demographic composition. There were some small differences between the Welsh and English samples: Income levels were somewhat lower and fewer people knew or were willing to disclose their income in Wales than in England; and the Welsh samples were more rural than the English ones. These differences reflect differences in the makeup of the respective populations.

Measures

The questionnaire contained 32 questions on the topics of own bag use; support for and attitudes towards the carrier bag charge; waste-related and non-waste related environmental behaviours; environmental identity and concern; waste knowledge; and socio-demographic background information (see Poortinga et al., 2012). Only the variables that are used in this paper are described below.

Current levels of own bag use were assessed by asking (1) 'At your last visit to the supermarket, did you bring your own bag?'; (2) 'How often do you take your own bag/s to the supermarket?'; and (3) 'How often do you take your own bag/s to other shops?'. Respondents could answer the first question with 'yes', 'no', or 'don't know'. The latter two questions could be responded to by answering 'always', 'often', 'occasionally', or 'never'. The acceptability of the single-use carrier bag charge was assessed by asking respondents 'How strongly do you support or oppose a five pence charge on single-use carrier bags?', with a five-point response scale ranging from 'strongly support' to 'strongly oppose'.

Respondents' attitudes to the charge were indicated by responses to three agree-disagree statements: 'Charging five pence for each single-use carrier bag is a good way of reducing waste'; 'Charging five pence for each single-use carrier bags helps to reduce litter'; and 'I am more willing to pay a five pence charge for a single-use carrier bag if the money goes to charity'. The three items could be combined into a reliable scale (Cronbach's $\alpha=0.77$).

The questionnaire included four agree-disagree statements that were designed to assess respondents' waste and environmental identity (e.g. 'I think of myself as a waste conscious person' and 'I think of myself as someone who is very concerned about environmental issues', respectively). The four statements formed a highly reliable environmental identity scale (Cronbach's $\alpha=0.87$).

The following waste-related and non-waste related environmental behaviours were included in the survey: Buying products with less packaging; Recycling household waste; Repairing or maintaining an item to avoid buying something new; Walking or cycling short distances (i.e. trips of less than 3 miles); Turning off the tap while brushing your teeth; Buying energy-saving light bulbs; and Washing clothes at 30 degrees or less. Respondents indicated if they 'always' 'often', 'occasionally', or 'never' took these actions. No reliable scales could be constructed from these behaviours. Potential spillover effects were tested for each of the seven waste-related and non-waste related environmental behaviours.

Statistical Analysis

The data were analysed using two-way Analysis of Variance (ANOVA), making comparisons of the independent 'before' and 'after' samples. These analyses show the relative changes in Wales as compared to England. The two-way ANOVA included 'measurement occasion' (before or after the introduction of the carrier bag charge) and 'country' (Wales or England) as the fixed factors. Interaction effects show non-additive effects of the two factors, indicating changes that can be attributed to the carrier bag charge.

Results

Own Bag Use

When respondents were asked if they brought their own bag to the supermarket at their last visit (see Figure 1), a significant difference was found between the before and after samples ($F(1, 2173)=81.373, p<0.001$). Overall, respondents were more likely to report that they brought their own bag after the introduction of the charge. A significant difference was also found between the Welsh and English samples ($F(1, 2173)=12.176, p<0.01$), with the Welsh samples being more likely to report that they took their own bag to the supermarket at their last visit. The Welsh and English samples had similar levels of own bag use before the introduction of the charge. Although increases in own bag use were observed in both samples, the increase was greater in Wales than in England ($F(1, 2173)=4.206, p<0.001$). The increase in England may reflect a wider change in norms relating to disposable carrier bags in the UK (cf., Clapp & Swanston, 2009) and other voluntary efforts from supermarkets to reduce carrier bag use (e.g. moving them out of sight).

Figure 1: At your last visit to the supermarket, did you bring your own bag (% yes)

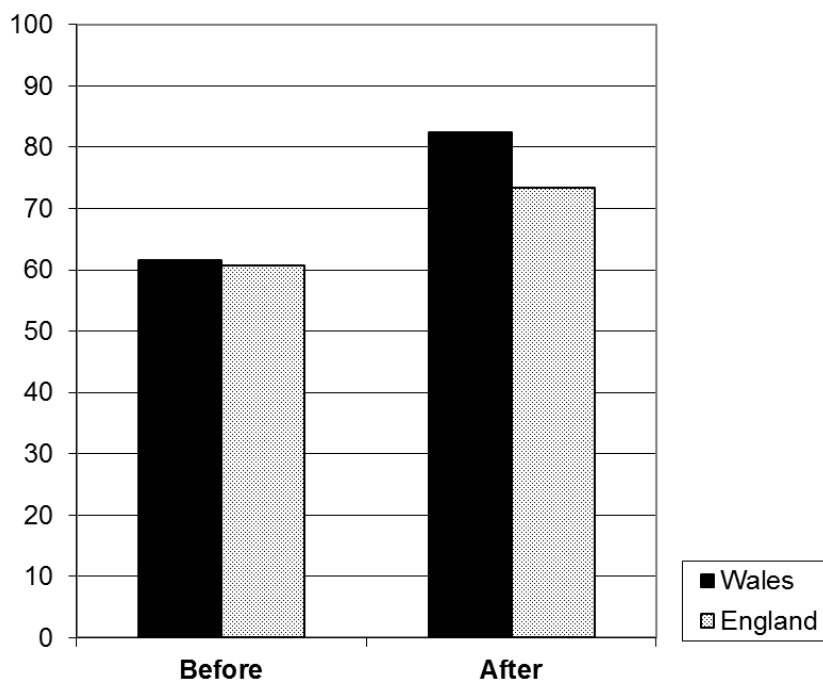


Figure 2a shows the percentage of respondents that indicated 'always' bringing their own bag/s to the supermarket. A significant difference was found in the number of respondents who always take their own bag/s to the supermarket between the before and after samples ($F(1, 2199)=42.841, p<0.001$), with respondents being more likely to do so in the 'after' samples. A significant difference was also found between the Welsh and the English samples ($F(1, 2199)=13.680, p<0.001$), with the Welsh samples being more likely to always bring their own bag/s to the supermarket than the English sample. Before the introduction of the charge, the Welsh respondents were slightly less likely to always bring their own bag/s to the supermarket than the English respondents. While own bag use also increased in England, the increase was greater in Wales ($F(1, 2199)=12.246.135, p<0.001$).

Figure 2: How often do you take your own bag/s to (a) the supermarket and (b) other shops (% always)

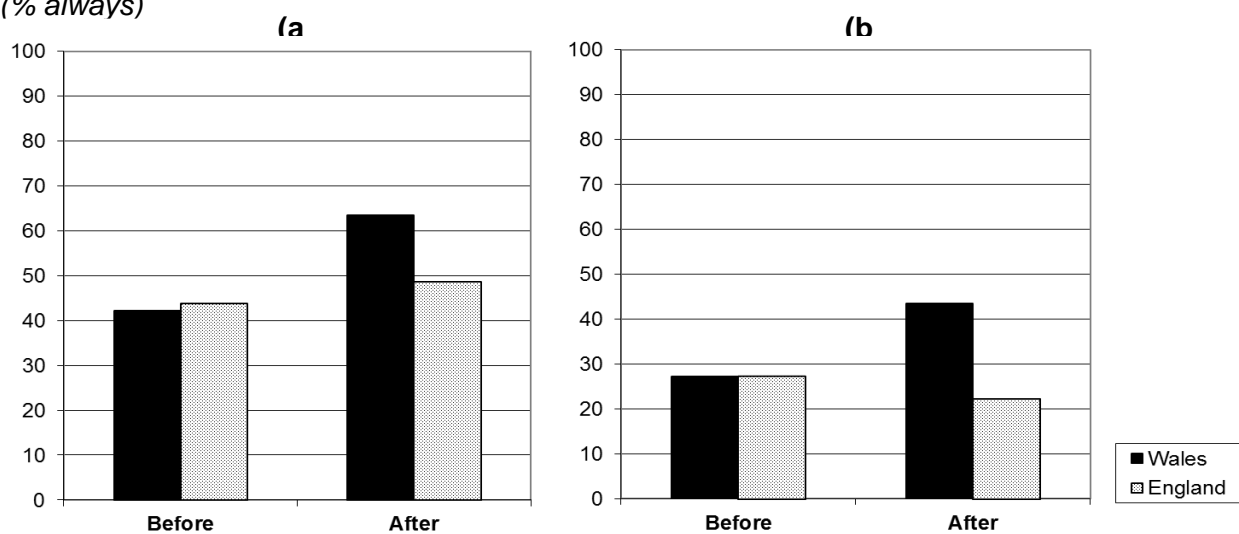
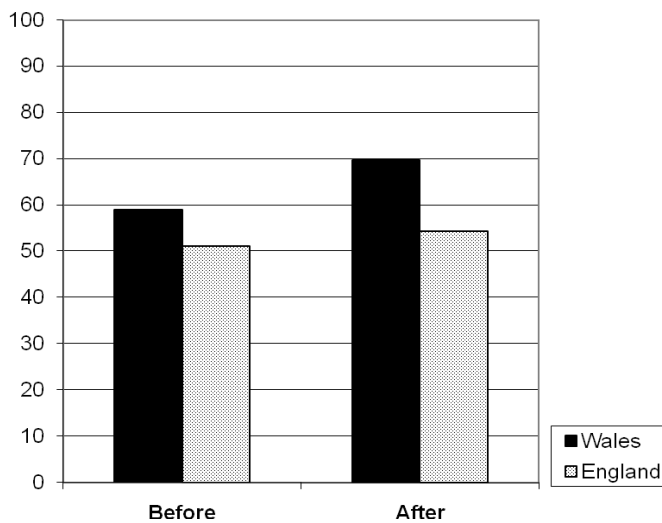


Figure 2b shows the percentage of respondents that indicated 'always' bringing their own bag/s to other shops. There was a significant difference between the before and after samples ($F(1, 2199)=14.054, p<0.001$). Overall, respondents were more likely to always bring their own bag/s to other shops after the introduction of the carrier bag charge than before. A significant difference was also found between the Welsh and the English samples ($F(1, 2199)=36.677, p<0.001$), with the Welsh samples being more likely to always bring their own bag/s to other shops. Before the charge was introduced, Welsh and English participants were equally likely to always take their own bag/s to other shops. Although own bag use to other shops increased in Wales, it decreased in England. This interaction effect was highly statistically significant ($F(1, 2199)=27.589, p<0.001$).

Figure 3: How strongly do you support or oppose a five pence charge on single-use carrier bags (% strongly support)



Support for the Carrier Bag Charge

Figure 3 shows that, overall, there was more support for a five pence charge in the 'after' samples than in the 'before' samples ($F(1, 2199)=9.043, p<0.01$); Welsh respondents were generally more supportive of a five pence charge than English respondents ($F(1, 2199)=33.820, p<0.001$); and that there was a greater increase in support for a five pence charge in Wales than in England ($F(1, 2199)=3.998, p<0.05$) following its introduction.

Attitudes towards the Carrier Bag Charge

Figure 4 shows the average scores of the scale combining the three attitude statements. Attitudes to a five pence carrier bag charge were found to be more positive after the introduction of the charge ($F(1, 2199)=11.506, p<0.001$). Overall, attitudes to a five pence charge were more positive in Wales than in England ($F(1, 2199)=15.051, p<0.001$). However, no interaction effect was found ($F(1, 2199)=0.343, p=0.558$). While attitudes in Wales were more positive after the introduction of the carrier bag charge, a comparable increase was found in England.

Figure 4: Attitudes to a five pence carrier bag charge (scale 1-5)

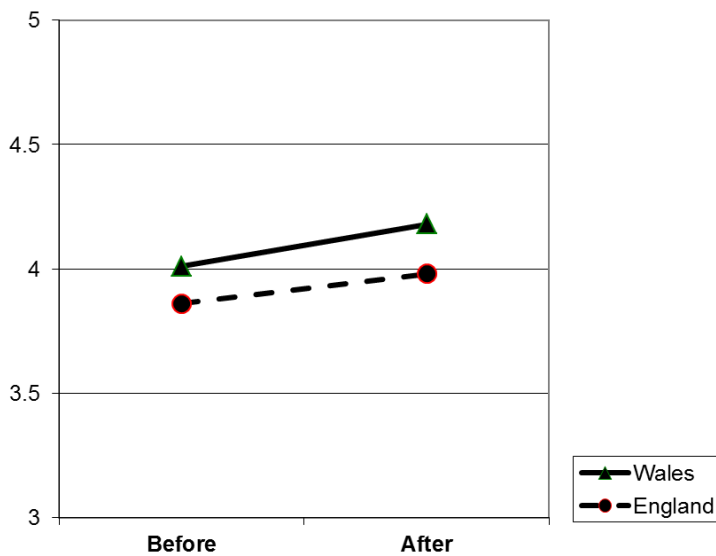
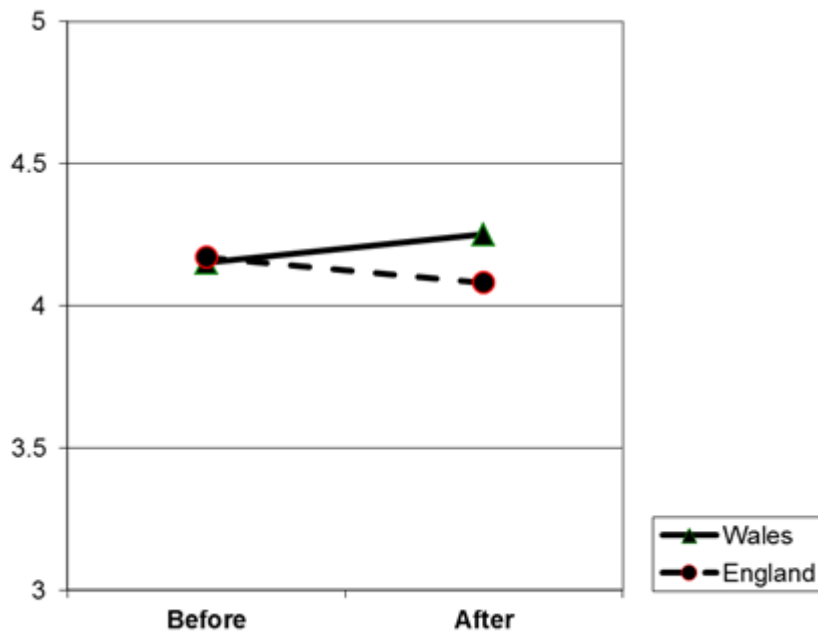


Figure 5 shows that, overall, there were no significant differences in environmental identity before and after the introduction of the carrier bag charge ($F(1, 2199)=0.259$ $p=0.611$). Environmental identity was slightly higher in the Welsh samples than in the English samples ($F(1, 2199)=5.226$, $p<0.05$). A significant interaction effect was found ($F(1, 2199)=8.126$, $p<0.01$). Whereas environmental identity increased in Wales, it decreased in England.

Figure 5: Environmental identity (scale 1-5)



Waste-Related and Non-Waste Related Behaviours

No evidence for behavioural spillover was found in this study, as there were no significant interaction effects for any of the seven waste-related and non-waste related environmental behaviours. While there was an increase in recycling household waste ($F(1, 2199)=10.094$, $p<0.001$) and buying energy-saving light bulbs ($F(1, 2199)=4.441$, $p<0.05$), the increase was of a similar size in England and Wales ($F(1, 2199)=0.014$, $p=0.907$; and $F(1, 2199)=1.853$, $p=0.174$, respectively)

Discussion

This study aimed to evaluate the introduction of the single-use carrier bag charge in Wales by setting up a controlled field experiment with independent before and after samples. Key objectives of the study were to examine the effectiveness of the charge to reduce the use of single-use carrier bags (as indicated by own bag use); changes in support for and attitudes towards the charge; and potential behavioural spillover effects brought about by the charge.

The charge appeared highly effective in changing its target behaviour of carrier bag use. Own bag use in Wales increased from 61% before to 82% after the introduction of the carrier bag charge. While own bag use also increased in England, the increase was much smaller than in Wales. The carrier bag charge appears to have established a change of habits in Wales. Many people in Wales now 'always' bring their own bag to the supermarket (an increase from 42% to 64%) and to other shops (an increase from 27% to 43%). The increase in the habit of bringing a reusable bag to the supermarket was much smaller in England; and England even saw a decrease in the habit of bringing a reusable bag to 'other' shops. These findings appear to be consistent with the 'habit discontinuity' hypothesis in that people have adopted a new – more sustainable – habit after the carrier bag charge successfully disrupted the old – less sustainable – one by making the choice of using disposable carrier bags more deliberate (cf. Verplanken et al., 2008). It is however not clear from this study whether the change was brought about by cost-avoidance (i.e. people not willing to pay the charge) or 'self-activation' (i.e. people bringing behaviour in line with their values). The self-activation hypothesis would be a plausible explanation, considering that many people in Wales already had a waste-conscious identity before the introduction of the charge (see below).

The study identified a number of attitudinal responses to the charge that may be informative to environmental policy makers. While support for the single-use carrier bag charge was already high before it was implemented, the Welsh population became even more supportive after its introduction. Support for the charge increased from 59% before to 70% after its introduction. In England, support for a five pence charge remained stable over the same time period. These results are in line with the predictions and appear to be caused by cognitive dissonance and self-perception processes (Festinger, 1957; Bem, 1967). The observed changes in environmental identity reflect the patterns of behaviour change in England and Wales, and are also consistent with the increased support for the carrier bag charge in Wales. While environmental identity was higher after the carrier bag charge was introduced in Wales, it decreased in England in the same time. However, not all attitudinal changes were as expected. Even if, as predicted, attitudes to the single-use carrier bag charge became more positive after its introduction in Wales, this effect may not be ascribed to the policy and associated cognitive dissonance/self-perception processes, as a comparable increase was found in England where no such charge was introduced. It is therefore likely that these results reflect a wider change in norms relating to disposable carrier bags in the UK (cf., Clapp & Swanston, 2009), and could suggest that the other UK countries are ready for similar legislation to reduce its use.

The study found no support for behavioural spillover. Very few real changes in waste-related and non-related behaviours were observed after the charge was introduced in Wales.

Although this suggests that there has been no positive spillover to other environmental behaviours, there are a number of methodological and theoretical explanations for the absence of such an effect. First, the study may not have had sufficient statistical power. The sample sizes may have been too small to observe the changes in other waste-related environmental behaviours. This is however unlikely, as the study was designed to be able to detect medium to small effect sizes. Second, it was only possible to include a limited number of waste-related and non-waste related environmental behaviours due to space limitations in the survey. It is possible that the effects have spilled over to other behaviours that were not included in this study. At the same time, the questions themselves may not have been sensitive enough to identify subtle changes in (the frequency of) these environmental behaviours. A third explanation is that spillover effects did not occur because carrier bag use is the 'wrong' behaviour to establish behavioural spillover. Behaviour spillover is thought to only happen with certain 'catalytic' or 'wedge' behaviours that serve as entry points for further changes. Cognitive dissonance will only emerge and thus lead to further changes if the changed behaviour is *diagnostic* of an internal disposition of environmental values or identity. It is possible that the behaviour of bringing one's own reusable carrier bag does not have the diagnosticity needed to bring about further changes (i.e. it is not perceived as a typical environmental/waste behaviour). The fourth (related) explanation why spillover may not have happened is that the behaviour change has been motivated by cost avoidance, which would explain why the Welsh public do not perceive inconsistency in their waste practices. Engagement in the more sustainable behaviour is then externally rather than internally attributed (Malle 2004). While it is possible that the change will then spread to similar cost-saving behaviours (because people may begin to perceive themselves as someone who does things for financial savings), it is less likely to lead to other environmental behaviours that do not involve cost-savings. As indicated by Evans and colleagues (2012) it is critical that the change in behaviour is (perceived to be) undertaken for environmental reasons in order to establish spillover to other environmental behaviours.

The study has a number of weaknesses and left open a number of questions regarding the processes contributing to behavioural spillover. These need to be addressed in future research. Most notably, the study used 'independent' samples to evaluate the effectiveness and further attitudinal and behavioural impacts of the carrier bag charge in Wales. Although the samples were carefully recruited and weighted to ensure that they were representative of the Welsh and English populations respectively and showed shifts at the population level in accordance with the expectations, it is not possible to conduct more detailed analyses at the individual level. It is essential to conduct such individual-level analyses in order to test and understand the different processes that may explain the attitudinal changes and behavioural spillover. A repeated measures type design would show which individuals have changed their behaviour as a result of the carrier bag charge and which processes could have contributed to that. For example, it could show whether environmentally concerned individuals are more likely to change their behaviour in accordance with their values, as can be expected from habit discontinuity and self-activation theory (Verplanken et al., 2008). Furthermore, the current study did not explicitly ask participants about the reasons for behaviour change and about the perceived benefits and drawbacks of the carrier bag charge. This would not only show how experiences of the new situation can bring about attitude change (cf., Schuitema et al., 2010), but would also allow more detailed analyses to

show under which conditions behavioural spillover may or may not occur (cf., Evans et al., 2012). The latter would provide field experimental evidence showing whether people who change their behaviour for environmental reasons are more likely to engage in further behaviour change than those who change their behaviour for more self-interested financial reasons. It might also indicate whether environmental communications should in future accompany the introduction of environmental policies (e.g., carrier bag charges) to prime environmental values and ensure spillover is towards other environmental, rather than money-saving, behaviours. The third issue that should be addressed in further research is to explore a wider variety of processes that promote (or inhibit) behavioural spillover. The current study mainly focused on environmental identity as a possible pathway, based on theoretical predictions from cognitive dissonance and self-perception theories. It is likely that multiple processes are at work in different contexts. For example, by engaging in an environmental behaviour, individuals may acquire knowledge or learn skills that make other environmental behaviours easier to conduct (Thøgersen & Crompton, 2009).

Despite these limitations, the study has made a considerable contribution to understanding the attitudinal and behavioural implications of environmental policy. The evidence so far has been either correlational (in the case of behavioural spillover) or uncontrolled (for attitude change). While Evans and colleagues (2012) conducted an elegant lab experiment suggesting the importance of activating environmental values to establish behavioural spillover, the current study constitutes the first 'controlled' field experiment to evaluate the attitudinal and behavioural impacts of a 'real' environmental policy. Carefully designed field experiments that have sufficient ecological validity are needed to provide policy-makers with high-quality evidence of the effectiveness and further impacts of their policies. The attitudinal responses to the carrier bag charge observed in this study suggest that environmental policy-makers may be bolder in implementing policies that have a certain level of support, are easily adapted to, and have clear benefits. Together with evidence provided by evaluations of the introductions of the 'plastax' in Ireland, congestion charges in London and Stockholm, and various smoking bans, the current study suggests that effective environmental and behaviour change policies may become more popular after their implementation, and have the ability to change attitudes afterwards. While the study found no support for spillover effects to other environmental behaviours, it also did not find evidence for negative spillover or 'licensing'. That is, people were *not* less likely to perform other waste-related or non-waste related environmental behaviours as a result of feeling 'having done their bit'. Furthermore, the study did observe changes in environmental identity that may bring about behavioural spillover in the longer term. There is now a need for further research to study the long-term effects of behaviour change policies, such as the carrier bag charge, as well as in-depth field-experimental studies to examine study the processes and specific conditions under which spillover effects may or may not occur. Such research will be vital for policy-makers in other countries currently considering introducing carrier bag charges, and how these might be most effective in fostering spillover as well as change in targeted behaviours.

References

- Barr, S., Gilg, A. W., & Ford, N. (2005). The household energy gap: examining the divide between habitual-and purchase-related conservation behaviours. *Energy Policy*, 33, 1425–1444.
- Bem, D. J. (1967). Self-perception: an alternative interpretation of cognitive dissonance phenomena. *Psychological Review*, 74, 183-200.
- Borland, R., Owen, N., Hill, D., & Chapman, S. (1990). Changes in acceptance of workplace smoking bans following their implementation: A prospective study. *Preventive Medicine*, 19, 314-322.
- Clapp, J., & Swanston, L. (2009). Doing away with plastic shopping bags: international patterns of norm emergence and policy implementation. *Environmental Politics*, 18, 315-332.
- Convery, F., McDonnell, S., & Ferreira, S. (2007). The most popular tax in Europe? Lessons from the Irish plastic bags levy. *Environment and Resource Economics*, 38, 1-11.
- Defra (2008). *A Framework For Pro-Environmental Behaviours*. London: Department for Environment, Food & Rural Affairs.
- Drury Research (2000). *Attitudes and actions – a national survey on the environment*. Research on behalf of the Department of the Environment and Local Government. Dublin: Drury Research.
- Evans, L., Maio, G. R., Corner, A., Hodgetts, C. J., Ahmed, S., & Hahn, U. (2012). Self-interest and pro-environmental behaviour. *Nature Climate Change*; doi:10.1038/nclimate1662.
- Festinger, L. (1957). *A theory of cognitive dissonance*. Stanford: Stanford University Press.
- Gaunt, M., Rye, T., & Allen, S. (2007). Public acceptability of road user charging: The case of Edinburgh and the 2005 referendum. *Transport Reviews*, 27, 85-102.
- He, H. (2010). *The effects of an environmental policy on consumers: lessons from the Chinese plastic bag regulation*. Working Papers in Economics, No 453. Gothenburg: School of Business, Economics, and Law, University of Gothenburg.
- Malle, B. F. (2004). *How the mind explains behaviour*. Folk explanations, meaning, and social interaction. London: MIT Press.
- Mazar, N., & Zhong C-B. (2010). Do Green Products Make us Better People? *Psychological Science*, 21, 494-498.

Owen, N., Borland, R., & Hill, D. (1991). Regulatory influences on health-related behaviours: The case of workplace smoking-bans. *Australian Psychologist*, 26, 188-191.

Poortinga, W., Spence, A., Demski, C., & Pidgeon, N. F. (2012). Individual-motivational factors in the acceptability of demand-side and supply-side measures to reduce carbon emissions. *Energy Policy*, 48, 812-819.

Poortinga, W., Whitmarsh, L., & Suffolk, C. (2012). Evaluation of the introduction of the single-use carrier bag charge in Wales: attitudes change and behavioural spillover. Technical Report to the Welsh Government. Cardiff: Welsh School of Architecture, School of Psychology.

Schuitema, G., Steg, L., & Forward, S. (2010). Explaining differences in acceptability before and acceptance after the implementation of a congestion charge in Stockholm. *Transportation Research Part A: Policy and Practice*, 44, 99-109.

Seo, D-C., Macy, J. T., Torabi, M. R., & Middlestadt, S. E. (2011). The effect of a smoke-free campus policy on college students' smoking behaviors and attitudes. *Preventive Medicine*, 53, 347-352.

Spence, A., & Pidgeon, N. F. (2009). Psychology, climate change and sustainable behaviour. *Environment*, 51, 8-18.

Thøgersen, J. (1999). Spillover processes in the development of a sustainable consumption pattern. *Journal of Economic Psychology*, 20, 53-81.

Thøgersen, J. (2004). A cognitive dissonance interpretation of consistencies and inconsistencies in environmentally responsible behavior. *Journal of Environmental Psychology*, 24, 93-103.

Thøgersen, J., & Crompton, T. (2009). Simple and painless? The limitations of spillover in environmental campaigning. *Journal of Consumer Policy*, 32, 141-163.

Thøgersen, J., Noblet, C., (2012). Does green consumerism increase the acceptance of wind power? *Energy Policy*, 51, 854-862.

Tietenberg, T., Button, K., & Nijkamp, P. (1999). *Environmental instruments and institutions*. Cheltenham: Edward Elgar.

Transport for London (2004). Congestion charging central London: Impacts monitoring second annual report. <http://www.tfl.gov.uk/assets/downloads/Impacts-monitoring-report-2.pdf>.

Verplanken, B., Aarts, H., van Knippenberg, A., & Moonen, A. (1998). Habit versus planned behaviour: A field experiment. *British Journal of Social Psychology*, 37, 111-128.

Verplanken, B., Walker, I., Davis, A., & Jurasek, M. (2008). Context change and travel mode choice: Combining the habit discontinuity and self-activation hypotheses. *Journal of Environmental Psychology*, 28, 121-127.

Whitmarsh, L., & O'Neill, S. (2010). Green identity, green living? The role of pro-environmental self-identity in determining consistency across diverse pro-environmental behaviours. *Journal of Environmental Psychology*, 30, 305-314.

Welsh Assembly Government (2010). Towards zero waste. One Wales: One planet. Overarching waste strategy document for Wales, June 2010.