Applying Social Identity Insights to Encourage Climate Resilient Water Behaviour

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To Karen Black and Lutz Lede

Who taught us the meaning of resilience

Abstract

Water scarcity is one of the most pressing issues of our time and it is projected to increase as global demand for water surges and climate change limits fresh water availability. If we are to reduce water demand, it is essential we draw on every tool in the box. Research from the behavioural sciences demonstrates that our behaviour is strongly influenced by others. Social norms messaging, which communicates what others are doing or what behaviour is expected in a given context, has been shown to offer a cost-effective avenue to encourage proenvironmental behaviour change, and more recently, climate resilient water behaviour. The Social Identity Approach, which seeks to explain how individuals are shaped by the groups to which we belong, posits that normative messaging may be even more effective if norms are framed in reference to behaviourally-relevant groups – our *ingroups*. This thesis develops and tests a novel approach; an *ingroup norms appeal*. Utilising social identity insights, it was predicted that messages highlighting a social identity (e.g. a local community) while promoting ingroup norms favouring climate resilient water behaviour would encourage corresponding behavioural change amongst group members. Across five studies, including two large-scale experimental field trials, this thesis provides the first comprehensive empirical examination of an ingroup norms appeal in the context of water conservation. This research demonstrates that not only is the appeal effective in motivating climate resilient water behaviour, it is more efficacious than alternative message-based interventions, such as an information-only campaign or a general social norms appeal. Mediating and moderating variables are also examined. Importantly, this research bridges the theoretical-practice gap. Research collaborations were established with industry partners and the appeal is now being utilised within the UK water sector to engage water end-users.

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Contents

List of Figures

List of Tables

List of Acronyms and Abbreviations

BIT	Behavioural Insights Team
Defra	Department for Environment, Food & Rural Affairs
TPB	Theory of Planned Behaviour
UEA	University of East Anglia
UK	United Kingdom
WDM	Water Demand Management

1 Introduction and Overview [1] [2]

Fresh water is a finite resource and in regions that experience water scarcity, the impacts can be insidious and far-reaching. The World Economic Forum (2015) declared that water crises were the top global risk in terms of impact. Global water scarcity is projected to intensify as climate change alters the hydrological cycle (Gosling & Arnell, 2016; Schlosser et al., 2014) and as an increase in population and economic growth lead to a surge in demand for water (Mekonnen & Hoekstra, 2016; OECD, 2012). In the domestic sector alone, global water demand is anticipated to increase by 30 percent by 2050 (OECD, 2012). To maintain long-term water supply and achieve water security in the face of disruption – to be *resilient* (Committee on Climate Change, 2016; Ofwat, 2015) - we must reduce the amount of water being consumed or enable water to be used more efficiently. Measures to achieve this, termed *Water Demand Management* (WDM), are considered to be the most sustainable approach to achieve water supply security (White, Turner, Fane, & Giurco, 2007). If effectively implemented, WDM strategies may exert a positive flow-on effect to the entire water and wastewater system (Willis, Stewart, Giurco, Talebpour, & Mousavinejad, 2013) and contribute to a reduction in the residential carbon emissions associated with heating water (18 percent of total household energy-related emissions; Palmer & Cooper, 2013).

Different WDM strategies are available, including financial mechanisms (e.g. price increases; water tariffs; financial penalties for overuse) or voluntary demand

[1] Parts of this thesis form the manuscript Lede, E & Meleady, R. (2018). Applying social influence insights to encourage climate resilient domestic water behaviour: Bridging the theory-practice gap (*Accepted/In press*) in Wiley Interdisciplinary Reviews (WIREs) Climate Change

[2] Parts of this thesis form the manuscript Lede, E, Meleady, R. & Seger, Charles R. (2018). Applying social identity insights to motivate residential water conservation *(Under revision)*

management tools (e.g. a behaviour change campaign) (Hassell & Cary, 2007; Renwick & Green, 2000). These approaches may serve to be complementary and can be implemented in unison (Inman & Jeffrey, 2006). While price-based mechanisms may be appropriate when the behaviour entails a financial outlay (e.g. a rebate for a retrofit of water efficient devices) (Allon & Sofoulis, 2006; Gilbertson, Hurlimann, & Dolnicar, 2011), voluntary demand side management tools such a water conservation campaign may offer an avenue to encourage a change in residential water behaviours, for example, motivating a change in day-to-day water behaviours or increasing sign-up rates to voluntary water efficiency programmes. Prior research has demonstrated message-based appeals can influence both habitual proenvironmental behaviours (e.g. energy efficiency in the workplace; Handgraaf, de Jeude, & Appelt, 2013) as well as one-off behaviours (e.g. sign-up to a tyre check for environmental reasons; Bolderdijk, Steg, Geller, Lehman, & Postmes, 2012).

The most utilised voluntary WDM strategy to motivate behavioural change in the residential domain is a large-scale persuasive communication campaign. Traditionally, proenvironmental communication campaigns have been formulated around the assumption of a *knowledge deficit;* the belief that suboptimal behaviour results from lack of knowledge (Burgess, Harrison, & Filius, 1998; Schultz, 2002). However, while an information-based approach may increase issue awareness (Willis, Stewart, Panuwatwanich, Williams, & Hollingsworth, 2011), this does not necessarily translate into behaviour change (Nieswiadomy, 1992; Syme, Nancarrow, & Seligman, 2000). Whilst providing information about the severity of water scarcity and what can be done to tackle it is important to convey, evidence suggests that on its own, information is unlikely to be sufficient to produce behaviour change (Cary, 2008).

1.1 Social Norms

A growing body of research suggests that it may be more effective to appeal to one's social motivations. More than 70 years of social psychological research has shown the power of social norms to influence behaviour (Cialdini & Goldstein, 2004; Griskevicius, Cialdini, & Goldstein, 2008). Social norms are 'rules and standards that are understood by members of a group, that guide and/or constrain human behaviour' (Cialdini & Trost, 1998, p. 152). Social norms serve as cues that help people make sense of social situations (especially those characterised by high uncertainty or ambiguity) in terms of how people are expected to behave. They motivate action by providing information about what is likely to be effective and adaptive. As Cialdini et al. (1990, p. 1015) put it, 'If everyone is doing it, it must be a sensible thing to do'. It follows that if 'what most others do' is known or communicated (e.g. through social marketing techniques) behaviour will align with the norm.

The social norms approach has emerged as an alternative to more traditional information-based approaches and is increasingly used to encourage proenvironmental behaviour change. A classic example of this approach is provided by Goldstein, Cialdini and Griskevicius (2008). Hotels often place messages in rooms to encourage guests to reuse their towels. The authors reported on the ability of a printed normative message to influence conservation behaviour among hotel guests. In one experiment, a standard informational request was placed in half of the rooms in the hotel that stated: '*Help save the environment by reusing your towels during your stay*'. The other half received an alternative message that additionally evoked a social norm: '*Join your fellow guests in helping to save the environment. Almost 75 percent of guests reuse their towels during their stay'.* Results showed

that simply changing a few words in this way reduced the number of towels washed by 26 percent. Rather than tell people *what to do*, it was more effective to tell them *what other people are doing*. This general effect has been replicated in other environmental domains including recycling (Nigbur, Lyons, & Uzzell, 2010); plastic bag use (Kim, Lee, & Hur, 2012); and energy conservation (Allcott, 2011; Costa & Kahn, 2013).

However, despite the power of social norms, we largely underestimate the role that it plays on our behaviour. In a study examining residential energy behaviour, residents received one of four persuasive appeals encouraging them to reduce their consumption: 1) *social norms appeal*; 2) *environmental appeal;* 3) *societal appeal;* 4) *financial appeal* (Nolan, Schultz, Cialdini, Goldstein, & Griskevicius, 2008). Residents rated the social norms appeal as least influential, yet, data on actual energy consumption revealed that this message resulted in significantly more conservation in comparison to the other conditions. Likewise, social norms approaches are underestimated by experts. In another study, energy experts were asked to evaluate the motivating potential of five energy conservation messages. The financial appeal was perceived to be the most motivating and the social norms appeal less motivating. The experts also stated they would be least likely to utilise the normative appeal in their future consumer engagement programmes (Nolan, Kenefick, & Schultz, 2011). As such, despite being an inexpensive and effective demand management option, social norms approaches are an underestimated, and as a result, an underemployed lever for encouraging proenvironmental behaviour (Allcott, 2011; Griskevicius et al., 2008).

One may reasonably anticipate that social norms strategies will be unlikely to generate the same magnitude of effects comparable with infrastructural or regulatory

change. For example, in Valencia, Spain, smart water pricing tariffs (where price changes with water availability) were found to deliver an 18% reduction of total water consumption (Lopez-Nicolas, Pulido-Velazquez, Rougé, Harou, & Escriva-Bou, 2018) and smart water metering and digital in-home displays reduced water demand by 7-10 percent in Sydney, Australia over an 18-month trial (Doolan, 2011). The effect sizes of applied social norms approaches to encourage climate resilient water behaviour (*see:* Chapter 2 for review) may be relatively modest in comparison.

However, the application of a social approach offers several advantages when compared to alternative WDM strategies. They do not require wide-sweeping reforms or infrastructural change and given the ease with which they can be integrated into existing programmes, social norms approaches may provide a cost-effective mechanism to incite behavioural change. Additionally, they may sustain or enhance intrinsic motivation. For example, a financial reward or punishment could potentially transform an appeal to act proenvironmentally from a moral or social (intrinsic) consideration to a financial (extrinsic) consideration (Deci, Koestner, & Ryan, 1999; Gneezy & Rustichini, 2000). Evidence suggests that for some voluntary proenvironmental behaviours, social norms appeals are more influential than financial appeals (e.g. Bolderdijk, Steg, Geller, Lehman, & Postmes, 2012; Handgraaf, de Jeude, & Appelt, 2013). Prior research in the UK has found that water consumption is not influenced to a high degree by financial considerations – relative to energy behaviour (Energy Saving Trust, 2013) - and as such, a non-financial mechanism may be appropriate to employ in a behaviour change intervention targeting climate resilient water behaviours. Ultimately, achieving reductions in domestic water demand is likely to require a combination of strategies. Thus, social

norms approaches offer a promising complementary approach to achieve the reductions in water demand that are required.

Examples of successful application of social norms approaches are available, particularly in the residential energy domain (most notably OPOWER; Allcott, 2011; Allcott & Mullainathan, 2010), and they are beginning to gain traction in the residential water domain, especially given the recent acknowledgement that water end-users should be given an active role in increasing water resilience, both in terms of climate adaptation and mitigation (Ofwat, 2015). If we are to successfully utilise social norms approaches within WDM strategies, as has been achieved in the energy sector, creative partnerships between the research community and industry must be established. This heeds to a recent call by Kahan and Carpenter (2017) for scientists to partner with practitioners to apply theoretical and lab-based findings to real-world settings in order to find workable solutions to the most pressing environmental challenges we face. Water scarcity is one of those challenges, and finding viable solutions necessitates drawing on every tool in the box, and harnessing the potential of underutilised, yet effective, approaches.

Recent advancements that examine how social norms approaches can be harnessed to encourage proenvironmental behaviour suggest that normative messaging will be even more effective if a group source and context is provided, that is, if social norms information is framed in reference to *behaviourally-relevant* groups, or *ingroups*. These findings can be understood through the lens of the Social Identity Approach (Turner, Hogg, Oakes, Reicher, & Wetherell, 1987; Turner, Wetherell, & Hogg, 1989), which seeks to explain how individuals' attitudes, emotions and behaviours are shaped by the groups to which we belong. Examining whether social identity insights can be harnessed to encourage climate resilient water

behaviour represents the theoretical and empirical aim of the present thesis. Specifically, this thesis aims to consider the utility of social norms techniques to encourage climate resilient water behaviour and to examine whether insights from the Social Identity Approach can be employed to enhance their effectiveness.

Overview

This thesis begins with a review of existing social norms approaches to encourage climate resilient water behaviour i the residential domain. *Chapter 2* is divided into two sections. *Chapter 2A* examines how social norms approaches (normative messaging and socially comparative feedback) have been employed to incentivise climate resilient water behaviour in water scarce regions. It examines the theoretical underpinnings of these approaches and investigates how these theoretical insights can be translated into practice, facilitated by partnerships between researchers and industry. *Chapter 2B* then investigates the potential for social identity insights to be harnessed to encourage climate resilient water behaviour. It begins by providing an overview of the Social Identity Approach and the key processes underlying the approach, before examining its potential application to proenvironmental behaviour change interventions, and more specifically, whether social identity insights can encourage climate resilient water behaviour when harnessed in a normative messaging intervention.

Chapter 3 is the first of four empirical chapters. It establishes the foundational empirical support for the effectiveness of the Social Identity Approach (herein referred to as an *ingroup norms appeal*) in encouraging climate resilient water behaviour. *Study 1* examines whether the approach is more effective than providing information alone and *Study 2* investigates a key underlying mechanism of the

approach; it establishes whether changes in perceptions of ingroup norms mediates the effect of an ingroup norms appeal on climate resilient water behaviour intentions.

Chapter 4 (Study 3) considers an important variable underlying social identity-interventions: group identification. The chapter examines whether the strength of one's social identity moderates the behavioural effect in the context of a residential water behaviour intervention.

Chapter 5 (Study 4) provides the first empirical test of an ingroup norms appeal against an alternative normative messaging intervention: a general social norms appeal. In a randomised control trial conducted at a university halls of residence and implemented in conjunction with the university and a business water utility provider, *Study 4* determines the comparative effects of the two interventions on climate resilient water behaviour. Self-reported behaviour is measured, rather than behavioural intentions.

Chapter 6 provides a further rigorous test of the ingroup norms appeal. Collaborating with the water utility provider in the East of England to implement a large-scale randomised control trial, *Study 5* examines whether the approach can encourage an increase in climate resilient water behaviour in a water scarce region in the UK.

Chapter 7 then considers the ramifications of these findings for understanding and encouraging climate resilient water behaviour in the residential domain. The wider implications of these findings are discussed and an argument is made for the importance of collaborative research in addressing the key environmental challenges we face.

2 The Social Identity Approach and Climate Resilient Domestic Water Behaviour

Chapter 2 is divided into two parts. Chapter 2A examines how social norms approaches have previously been harnessed to incentivise climate resilient water behaviour. It examines the theoretical underpinnings and investigates how these theoretical insights have be translated into practice. Chapter 2B then investigates the potential for social identity insights to be utilised to enhance the effectiveness of social norms techniques and encourage climate resilient water behaviour in the residential domain.

2.1 Chapter 2A: Utilising Social Norms to Encourage Climate Resilient Water Behaviour in the Residential Domain

Chapter 2A aims to review emergent examples of how social norms approaches have been successfully harnessed to encourage climate resilient water behaviour. The approaches presented in Chapter 2A have been selected as there is both empirical evidence demonstrating their effectiveness for encouraging water conservation efforts and examples of their application in the residential sector. In what follows, Chapter 2A provides a brief theoretical overview of the selected approaches and their empirical evidence base. It then goes on to review examples of how the theoretical-practice gap has been bridged and these techniques have been applied by industry to encourage behaviour change.

2.1.1 Social Norms Approaches

It is now widely recognised that communications that activate social norms can be effective in producing societally-beneficial behaviour. According to the *focus theory of normative conduct*, activating a social norm will generate a shift in

behaviour consistent with the norm (Cialdini, Kallgren, & Reno, 1991). A distinction is typically made between two types of norms: *descriptive norms* and *injunctive norms*. *Descriptive norms* convey information about what is commonly done (e.g. 'most people conserve water'), while *injunctive norms* (or 'prescriptive norms') convey what is commonly approved or disapproved of (e.g. 'most people believe conserving water is important'). Both types of norm motivate human action; people tend to do what is socially approved as well as what is popular, and research suggests that aligning a descriptive and injunctive message can be more powerful than delivering either alone (Cialdini, 2003).

There are times, however, when descriptive and injunctive norms are not aligned – such as in situations where the environmentally-harmful behaviour is prevalent (a negative descriptive norm). For example, in a study investigating the use of normative messages to reduce environmental theft, Cialdini and colleagues (2006) observed that when the descriptive norm was highlighted that 'many past visitors have removed petrified wood from the park', theft rates increased. However, when the injunctive norm was highlighted, 'please don't remove the petrified wood from the park', theft was reduced. Shifting attention to the prescriptive aspect of the norm can therefore provide a means to remedy a negative descriptive norm. The normative information provided in an intervention must be credible. For example, if a supportive descriptive norm is highlighted in a campaign (e.g. households do not water their lawn for more than ten minutes per day), yet this information is not supported by observations (e.g. residents observe their neighbours watering the lawn for thirty minutes on average per day), the approach may backfire, as individuals become more sensitive – and align their behaviour to – the observed negative descriptive norm (Cialdini et al., 2006).

More recently, evidence suggests that impressions of norms are sensitive to information beyond the here and now. Communicating a so-called *dynamic norm* may also offer a promising avenue to elicit behavioural change (Sparkman & Walton, 2017). A dynamic norm communicates the number of people who are shifting their behaviour towards the desired outcome and highlights the increasing positive support for the behaviour, for example: '30 percent of people have begun reducing their time in the shower'. Dynamic norms are said to influence behaviour as they motivate preconformity; people anticipate a future world in which that behaviour is normative and then conform to the emerging norm as if it were current reality (Sparkman & Walton, 2017). The following section will outline the empirical evidence around social norms and climate resilient water behaviour.

An example of how activating social norms can increase water conservation efforts is provided by Fielding and colleagues (2013). In a field experiment conducted in a water scarce region in Australia, a message providing water saving advice and highlighting descriptive norms surrounding water conservation led to a reduction in total water usage (compared to pre-intervention baselines), as measured with household smart water meters. Households in the normative messaging conditions were provided with information about the large number of '*low water using households*' who engage in water saving behaviour. For example: '*78 percent take shorter showers; 90 percent turn off the tap when they brush their teeth*'. What is notable is that the normative information related specifically to 'low water usage households', demonstrating that if the average consumption of the overall sample population is high it may be possible to provide information only about those who demonstrate the desired behaviour as a way of conveying a positive descriptive norm.

Another example of the use of descriptive norms is provided by Richetin and colleagues (2016). Participants were asked to wash their hands under the guise of a product-testing experiment. For some participants, the soap dispenser was printed with a normative message indicating that the majority of people turn off the tap when soaping their hands. These individuals were found to turn off the tap in greater proportions and use less water overall compared to those exposed to a control message about the formula used in the product. Lasting behaviour change was observed when participants returned to the laboratory one week later. This study demonstrates how normative messaging can be delivered via household products, thereby increasing the scalability of social norms techniques. Importantly, the results also suggest that normative messaging can be utilised to target specific, high-impact behaviours. In the UK, research by the Energy Saving Trust (2013) found the highest impact domestic water behaviours are: showering (33%), followed by toilet flushing (22%); and washing machine-associated water consumption (10%). In addition to targeting general residential water behaviours, social norms interventions may be utilised to encourage a change in a targeted behaviour/s, thereby potentially optimising the effect of a given intervention.

More recently, an experimental field trial demonstrated that in contexts where there was low engagement with water conservation (i.e. a negative descriptive norm), communicating a dynamic norm - information about how the social norm is changing in an upward fashion – can be successful in changing water-related behaviour. Sparkman and Walton (2017) displayed normative messages in a US college laundrette to encourage conservation of water while washing clothes. The authors tracked the number of times each laundry machine was used each day using automated logs digitally stored by each machine. The reduction in usage compared

to a no-message control condition was found to be larger when participants were exposed to a dynamic norms message (‘*Stanford Residents Are Changing: Now Most Use Full Loads! Help Stanford Conserve Water!’*), than a static norm message *(‘Most Stanford Residents Use Full Loads! Help Stanford Conserve Water!’*.

2.1.2 Socially Comparative Feedback

An additional social norms approach is *socially comparative feedback,* which seeks to activate norms through feedback. Households are provided with personalised feedback about their own water consumption, coupled with normative information about the consumption of other, similar households. The idea is that because the feedback provides information about the ‘average’ household’s consumption, it will serve as a point of comparison for an individual’s own consumption. Because people do not want to deviate from the standard, the norm acts as a magnet, and draws behaviour towards it. Notably, by referring to the consumption levels of ‘the average home in your neighbour’, such techniques may inadvertently also tap into the influence potential of ingroup norms.

Research suggests that providing an aligned injunctive message may also be important in encouraging persistent conservation efforts. In a field experiment aimed at encouraging energy conservation Schultz and colleagues (2007) observed that for customers whose energy usage was below the neighbourhood average, socially comparative feedback inadvertently encouraged an increase in consumption. Because people measure the appropriateness of their behaviour by how far away they are from the norm, being above or below the norm is deviant. Although providing descriptive normative information may decrease an undesirable behaviour among individuals who perform that behaviour at a rate above the norm (high water users), the same message may serve to increase the undesirable behaviour among

individuals who perform that behaviour at a rate below the norm (low water users). Importantly, Schulz and colleagues found that this undesirable '*boomerang effect'* was prevented when the descriptive information was accompanying by injunctive normative messages (in this case, through emoticons ☺ ☹), reminding low end-users that their behaviour is socially approved of.

In water scarce California, Schultz and colleagues (2016) demonstrated that providing socially comparative feedback coupled with water saving advice led to a reduction in residential water consumption. Three experimental conditions were compared to a no-treatment control: information-only (water saving tips); descriptive norms and information (water saving tips, personalised water consumption feedback, and feedback on the water consumption of similar households in their neighbourhood); and aligned norms and information (as above with the inclusion of injunctive norms emoticons). The intervention lasted for a period of one week, and it was found that households assigned to both the descriptive and aligned norms conditions consumed significantly less water compared to control households.

An evaluation of a socially comparative feedback intervention in Costa Rica demonstrated that the approach can be successfully implemented in a developing country context where access to resources, such as technological infrastructure, may be constrained (Datta et al., 2015). In this case, feedback was delivered through stickers or postcards and included with households' monthly water bills. Residents received feedback on their own water consumption in comparison to that of the average household in their neighbourhood. Households who consumed less than average in the preceding month received a green sticker with a smiling water droplet and text congratulating them on their efforts, while households consuming above average received a red sticker with a frowning water droplet. In comparison to the

no-treatment control, residents who received the feedback intervention significantly reduced their consumption throughout the two-month intervention between 3.7 to 5.6 percent. The programme evaluators determined that the intervention was cost-effective (the benefits of the programme outweighed the costs by between 6.5 to 13 times) and the results justified the expansion of the intervention to the entire municipality.

Longitudinal examinations of the effects of social comparative feedback interventions importantly suggests that effects can endure. In a large-scale field experiment conducted in Atlanta, US, residents (n = ~11,700) received a messaging campaign integrating water saving advice, a personalised letter outlining water availability challenges and appealing to residents to work together to save water, and socially comparative feedback (comparing water consumption in the previous summer to the utility's median consumer consumption value) (Bernedo, Ferraro, & Price, 2014). The intervention, which was applied once in the summertime, yielded an initial average reduction of 4.8 percent of total residential water consumption over the four-month post-intervention period. Although the effect size reduced by approximately 50 percent at the end of the first year, it remained detectable for up to six years.

2.1.3 Bridging the Theoretical-Practice Divide

To achieve the magnitude of reduction in water demand required, it is essential that these theoretical insights are translated into practice. In doing so, it may be possible to develop applied and evidence-driven approaches to encourage climate resilient water behaviour in the residential domain. The following section provides an overview of *how these approaches have been applied by the water industry, thus demonstrating* how the theoretical-practice divide has been bridged. While social

norms approaches are only just gaining traction within the water sector, these examples highlight the inherent potential in applying social norms techniques to encourage a reduction in water demand.

In keeping with the proposition that social norms techniques are underutilised, relatively few examples could be found of how social norms messages have been used by practitioners to encourage residential water conservation. The available evidence on social norms messaging as a stand-alone approach is mostly drawn from interventions aimed at residential landscaping. Landscaping is one of the highest-usage residential water behaviours in the US (Inskeep & Attari, 2014). In a bid to encourage residents not to water their lawns, several public water bodies in California have developed signs that can be pitched on residents' lawns. Slogans include: The San Diego County Water Authority's '*When in drought. I'm saving every day, every way'* (*see* Figure 1). The aim here is to communicate a supportive descriptive norm and as more residents display the signs on their lawns, it reinforces the idea that lots of others are partaking in the desired behaviour. Meanwhile, the City of Sacramento (2014) developed a sign stating: '*The grass isn't brown. It's gold. Gold is the new green'* (*see* Figure 2). This message incorporates both injunctive and dynamic norm elements. The aim is to communicate a changing social norm; whilst a green lawn once garnered social approval, it is now socially disapproved of.

Another example, with a different communication medium, is available from Southern California. A collaborative partnership between private sector organisations and a not-for-profit led to the development of the #H2NO campaign (2015). Residents were encouraged to print out leaflets and distribute them amongst their neighbours. The leaflets harnessed the power of social norms in a similar way

to the above example. One of the leaflets designed to be hung on neighbour's doors stated for instance: *'Did you hear? Green is so last season. Brown is in! Save water by letting your lawn go brown. Join the movement'*. Together, these examples demonstrate how normative messaging can be applied even when there is low initial engagement in climate resilient water behaviour. Unfortunately, there is no data available with which to confirm the success of the interventions in terms of how many individuals changed their behaviour in response to the normative messages, and how much water was saved as a result.

Figure 1 Example of normative messages used in drought-prone California. Source: San Diego County Water Authority

Figure 2 Example of normative messages used in drought-prone California. Source: City of Sacramento, San Diego County

Socially-comparative feedback is probably the most established of the social norms approaches within the water industry and the impact of such interventions have also been most extensively evaluated. In the US, WaterSmart Software partners with water utilities to deliver socially comparative feedback in reports that are sent to customers each month via direct mail or email (*see* Figure 3). In line with Schultz et al.'s (2016; 2007) and Fielding et al.'s (2013) methodological approach, they provide personalised water usage data, in conjunction with a descriptive social norm (overall mean water consumption of similar households, and mean water consumption of low water using households). An injunctive norm (what is socially approved or disapproved of) is also communicated with a smiley, neutral, or worried water droplet in attempt to avoid a boomerang effect (Schultz et al., 2007).

WaterSmart's approach was tested in a twelve-month randomised control trial in California (n = 3286), run by an external evaluation body. It demonstrated average water reductions of between 4.6 percent (sample representative of overall service area) to 6.6 percent (selected sample of households matching pre-determined selection criteria) following the dissemination of bi-monthly home water reports (Mitchell & Chesnutt, 2013). It was concluded that the approach was viable and cost-effective, as the unit costs for implementation were less than alternative demand management and water supply strategies. They also found that households exposed to the water savings reports were 2.3 times more likely to participate in subsequent audit and rebate programmes, thereby further extending the overall impact of the intervention.

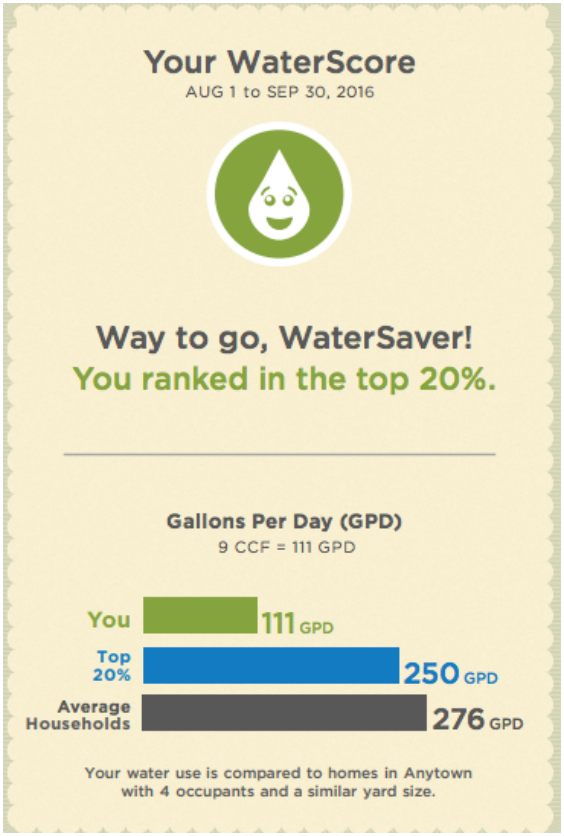

Figure 3 Socially comparative feedback presented in WaterSmart's home water reports disseminated in the US. Source: WaterSmart

A similar approach has also been applied in the UK by Advizzo and partnering water utilities. In a recent randomised control field trial in the South East of England (n = 2000), a one-off intervention message was delivered through direct mail-out. Households were provided with the average water consumption of both 'average' and 'efficient' neighbours with similar household characteristics, along with their own water consumption data and injunctive normative information; either a positive emoticon for 'Great' or 'Good' (*see* Figure 4). All households were also provided with water saving advice. The one-off mail-out led to a 2.2 percent reduction in water demand (compared to a control) over a six-month period (Hinton, 2017), as measured with smart water meter data. The success of the intervention in the UK and the US provides encouraging evidence for the generalisability of this approach.

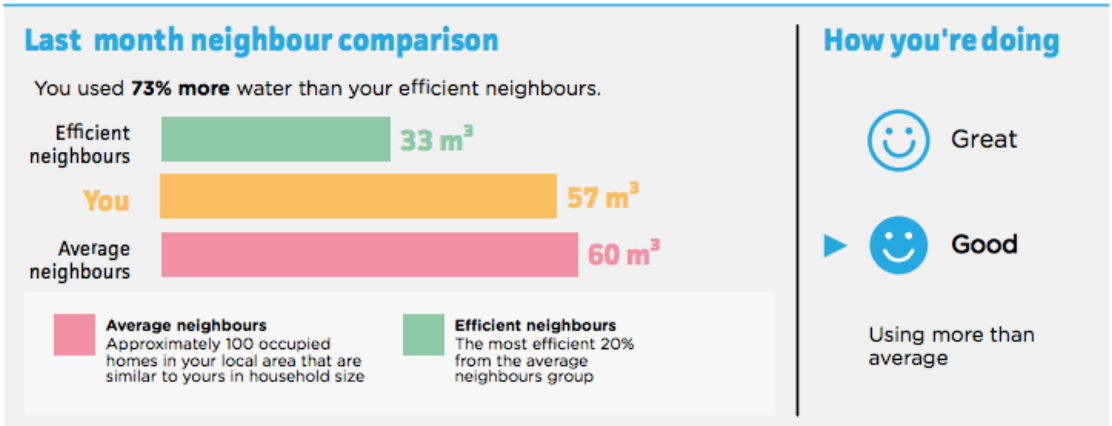

Figure 4 Socially comparative feedback presented in Advizzo's home water reports in the UK. Source: Advizzo

2.1.4 Summary and Conclusions

Chapter 2A demonstrated that social norms techniques can be utilised to encourage a reduction in water demand in the residential domain. The chapter provided a theoretical overview, before outlining the empirical evidence base around social norms interventions in the residential water domain. It then highlighted how these insights have been translated into practice in the water sector and encouragingly, where an evaluation of the results was possible, demonstrated that social norms approaches can make a meaningful contribution to water demand management strategies. It is now important to build on the existing empirical evidence base and understand whether there are ways to enhance the effectiveness of a social norms approach in the context of climate resilient water behaviour.

2.2 Chapter 2B: Optimising the Influence of Social Norms Interventions

The empirical evidence and applied examples offered in Chapter 2A demonstrated that social norms interventions provide a promising avenue to encourage climate resilient water behaviour. However, if these interventions are to meaningfully contribute to future water-demand management strategies, it is crucial we examine whether there is the potential to enhance the impact of such approaches. Insights from social identity theory and recent advancements in proenvironmental behavioural research suggest that one potential avenue to strengthen the effect of such interventions is to integrate social identity insights into the normative message. Our group memberships can influence our behaviour, and the Social Identity Approach suggests we may be able to harness this influence in a proenvironmental intervention. Given the importance of behavioural-based solutions to water challenges, it is vital that this avenue is investigated. The following section, Chapter 2B, will provide an overview of the Social Identity Approach; examine how it has been applied in the proenvironmental domain; and consider whether these insights can be translated to the residential water domain.

2.2.1 The Social Identity Approach

This thesis seeks not only to expand the empirical evidence base for social norms interventions as a means of encouraging climate resilient water behaviour, but also to consider how we can maximise the effectiveness of these interventions by drawing on insights from the Social Identity Approach. The Social Identity Approach incorporates two interrelated theories – Social Identity Theory (Abrams & Hogg, 1988; Tajfel & Turner, 1979) and its extension, Self-categorisation Theory

(SCT; Turner, Hogg, Oakes, Reicher, & Wetherell, 1987) – which seeks to explain how individuals' attitudes, emotions and behaviours are shaped by the groups to which we belong; our social groups. A *social group* is defined as 'a collection of individuals who perceive themselves to be members of the same social category' (Tajfel & Turner, 1986, p. 40). According to the Social Identity Approach, an important component of the self-concept is derived from our memberships to social groups. Individuals define themselves not only in terms of their personal traits (e.g. 'I am athletic'), but also in terms of their group memberships (e.g. 'I am British'). This group-based definition of the self forms an individual's *social identity*. *Social identity* is therefore defined as an individual's sense of belonging to social groups, together with the emotional and value significance these group memberships infer (Tajfel & Turner, 1986). Group memberships can be based on large-scale social categories (e.g. 'I am female'); groups we choose to belong to, such as professional groups (e.g. 'I am a researcher'); or interest-specific groups (e.g. 'I am a surfer') (Abrams & Hogg, 2006).

2.2.2 Social Identity Theory

Social Identity Theory (Abrams & Hogg, 1988; Tajfel & Turner, 1979) focuses on the interplay between personal and social identities and considers the effects of group membership on individual perceptions and group behaviour. Developed as an integrative theory, it aims to connect the cognitive and behavioural motivations underlying group membership. The theory enables an examination of the circumstances under which one defines themselves as an individual or a group member, and the consequences of social identification on perceptions and behaviour. It provides a lens through which group-based phenomena can be analysed and has been applied to understand group dynamics in differing contexts, such as intergroup

conflict and relations (e.g. Tajfel & Turner, 1979) and organisational behaviour and leadership (e.g. Ellemers, De Gilder, & Haslam, 2004; Hogg, 2001).

Social Identity Theory explores how individuals create and define their place in a social world; group memberships enable an individual to ascertain meaning in social contexts. Social Identity Theory assumes a basic motivation: the positive collective self-enhancement of the group and management of a collective self-esteem (Hogg & Abrams, 1988; Tajfel & Turner, 1986). This ameliorates a basic psychological need. Through the process of locating oneself in a social world, feelings of uncertainty are reduced, and the desire to establish a positively distinct (social) identity are met (Hogg, 2000; Hogg & Turner, 1987). This process is facilitated by identifying how the group an individual belongs to differs from relevant others. Self-esteem therefore becomes tied-up in group membership; group members seek to emphasise the positive and distinctive characteristics of their own group (their *ingroup*).

There are three psychological processes that are central to Social Identity Theory (Tajfel & Turner, 1986). The first is *social categorisation*, whereby individuals perceive themselves and others in terms of their group memberships, rather than as separate individuals. This enables individuals to understand their social world through a group-lens. The second process is *social identification*; the notion that an individual will adopt and internalise the identity of their ingroup, and in doing so, act as a group member should. This process is key to understanding social identity-based behavioural change and this process has been examined in depth, through an extension of Social Identity Theory: Self-categorisation Theory (examined in the following section). The third process is *social comparison*,

whereby individuals compare their ingroup with relative others (*outgroups*), to ascertain the relative standing of their ingroup and its members.

2.2.3 Self-categorisation Theory

Self-categorisation Theory (Turner et al., 1987) is an extension of Social Identity Theory and focuses on the cognitive aspects of self-identification to a group, and how this affects individual perceptions and behaviour in group contexts. Self-categorisation Theory – often referred to as the *social identity theory of the group* - examines the basic social-cognitive processes underlying group identification. *Group identification* is defined as the psychological attachment, or sense of belonging, a group member forms and sustains with their social group (Ellemers, Spears, & Doosje, 1997; Kelly, 2011). Leach and colleagues (2008) developed and validated a hierarchical model of ingroup identification. It proposes ingroup identification can be conceptualised as consisting of two components: *self-definition* and *self-investment*. *Self-definition* encompasses perceptions of similarity with other group members and perceptions of ingroup homogeneity. *Self-investment* describes an individual's positive feelings towards their ingroup; the importance of the group in relation to an individual's self-concept; and a sense of connectedness with the group (Leach et al., 2008). Ingroup identification varies in strength; on a spectrum from *no/weak* to *strong* ingroup identification. The strength of one's ingroup identification moderates the effect of social identity on perceptions and behaviour (Kelly, 2011). That is, if one highly identifies with a group, their perceptions and behaviour will be influenced to a higher degree by their group membership, in comparison to an individual who possesses a weak level of ingroup identification.

In line with Social Identity Theory, there exists a continuum between our personal and social identities. A social identity guides behaviour when it is

psychologically salient (Oakes, 1987). The salience of our personal or social identity will determine the extent to which the characteristics of that identity will inform our actions (Onorato & Turner, 2004; Seger, Smith, & Mackie, 2009). As a social identity is activated and becomes salient, other self-concepts will become less salient (Turner et al., 1987). Whether an identity is activated, and therefore salient, depends on two key factors: *accessibility* and *fit* (Oakes et al., 1991). *Accessibility* is the readiness of a social identity to be activated. It may be readily accessible as it is important and frequently employed (e.g. gender; profession), that is, it is chronically accessible in memory, or it may be situational dependent and fleetingly accessible (e.g. museum visitor). Accessible identities are utilised to make sense of social situations; they are used to check how well the categorisation accounts for the similarities and differences between people (*comparative fit*), and how well the stereotype of the categorisation accounts for people's behaviour (*normative fit*). This process is largely automatic. As contexts change, so too can the assessment of fit. For example, Scottish people are more likely to perceive themselves to be warm when comparing themselves to the English, than when comparing themselves to the Greeks (*comparative fit;* Hopkins, Regan, & Abell, 1997).

Self-categorisation Theory enables us to understand how one's membership to a group influences behaviour when the group identity is salient. A fundamental part of this process is *depersonalisation* (Hogg & Turner, 1987; Turner, 1985). When a social identity is salient, we undergo a process of depersonalisation, that is, we view ourselves in terms of the defining attributes of the ingroup, and we assimilate our perceptions, emotions, attitudes, and behaviour to that of the group stereotype. The process of depersonalisation is therefore a redefinition of the self in terms of group membership (Turner et al., 1987). Through this cognitive process of self-

categorisation to a group, the norms of the salient social group - *ingroup norms* - are internalised, and this systematically biases self-perception and behaviour so that it is in accordance with stereotypic ingroup norms (Turner et al., 1987). From this perspective, self-categorisation to a social group and the process of depersonalisation not only changes our behaviour to conform to the normative position of the ingroup, but also enables a sense of belonging, identification, and attachment. Through this, individual behaviour is transformed into group behaviour (Abrams & Hogg, 1990; Hogg & Turner, 1987).

2.2.4 Referent Informational Influence

It is this process that provides the vehicle for social influence under the Social Identity Approach. The Social Identity Theory of influence – *referent informational influence* (Hogg & Turner, 1987; Oakes et al., 1991; Turner, 1982) – examines the processes underlying the identification of and conformity to ingroup norms. Under the Social Identity Approach, social influence is driven by membership to a social group and this influence takes hold when a social identity is salient (Abrams, Wetherell, Cochrane, Hogg, & Turner, 1990). A seminal Social Identity Theory scholar, Turner (1982), argued that the source of social influence should lie with individuals who can provide trustworthy information regarding ingroup norms, rather than *general others*, who reward or punish socially sanctioned behaviour, or who provide information about reality.

In line with Turner's (1982) proposition, when a social identity is salient, group members will be highly attentive to information conveying *what* the ingroup norms are. Attention will be paid to the behaviour of, or information from, people who are most informed about the ingroup norm. Usually, this is a group member who is stereotypical of the group, or who is well-informed on ingroup behaviour

(Abrams & Hogg, 2006). Because ingroup norms are *internalised* as part of the individual's self-concept and are linked to his or her membership to that group, identification-based conformity to ingroup norms is not a process of surface compliance, but of genuine internalisation of a group's norms as one's own. Thus, conformity to the ingroup norms is intrinsically driven as it is underscored by internal cognitive change.

Referent informational influence therefore considers *normative influence* (public compliance as a result of social pressure) and *informational influence* (private acceptance of the nature of reality) as emanating from a single influence process connected to group membership and social identity (Abrams, Wetherell, Cochrane, Hogg, & Turner, 1990; Turner, 1982). This contrasts with normative and informational influence being conceptualised as two separate influence processes, under the alternative theoretical approach to social influence, as originally advanced by Deutsch and Gerard (1955). Under this approach, social influence emanates from other (general) individuals, whose categorisation or social memberships should have no effect - members of all groups should exert equal influence; they each carry equal weight in situations under which normative and informational influence processes operate.

The value of the Social Identity Approach and understanding the referent informational influence process is that it serves to clarify which '*others*' will influence behaviour. From this perspective, norms are tied to a specific group and exert their influence because that specific group is *behaviourally-relevant.* In contrast to social influence emanating from *general* others, one's ingroup becomes the vehicle for social influence.

Direct evidence of the referent informational influence process is provided by Terry, Hogg, and McKimmie (2000). Terry and colleagues provided information about the ingroup norm to participants and observed the subsequent effect on behaviour. In the first of two experiments, a social identity (psychology student) was made salient and information relating to the normative position of the ingroup was manipulated. Participants learnt that the ingroup norms regarding preferred career choice was either supportive, neutral, or not supportive of their own position. Participants who were exposed to a supportive or neutral ingroup norm, were more likely to maintain their initial career choice, as opposed to those who were confronted with an unsupportive ingroup norm; when participants were provided with feedback that their initial career choice ran counter to the group's normative position, they became more likely to alter their prior stance and their selection of which career talk to attend so that it was more consistent with the ingroup norm. The research showed that individual attitudes were more likely to predict behaviour if accompanied by supportive normative information from a behaviourally relevant reference group.

This finding was replicated in a second experiment, which sought to extend experiment one by manipulating ingroup salience. Participants in the high identity salience condition were sat closely together near clearly visible banners indicating their group categorisation (e.g. Red Group) and were told that the aim of the study was centred around group (jury) decision making. They were divided into groups based on socio-demographic variables and were identified by group name. In comparison, participants in the low salience condition were distributed around the room, identified themselves by their own name, and were informed that the study was investigating how individual jury members make decisions. When exposed to

ingroup normative information (attitudes towards five crimes) that ran counter to an individual's initial position, individuals were more likely to revise their initial attitude to be consistent with the ingroup norm when the group was a salient basis for self-definition (high group salience condition). This effect was more discernible for individuals who possessed higher levels of identification to the ingroup. That is, individuals who perceived themselves as group members, tended to act consistently with information about the normative position of the group when their group membership was salient. The findings showed that when a group membership was the salient basis for self-conception, individuals were motivated to bring their behaviour in line with the ingroup norm. These experiments provide additional support of the referent informational influence process and demonstrate that if individuals identified with a group and that social identity was salient, they would attempt to align their behaviour with the information provided regarding ingroup norms.

In further support of the process of referent informational influence and the role of ingroup norms in guiding behaviour, experimental research demonstrates that classic social influence effects (e.g. Asch, 1955; Sherif, 1936), do not occur when the source of social influence is an outgroup member. Abrams and colleagues (1990) extended Sherif's (1936) research on norm formation, and found that individuals converge quickly on an agreed frame of reference, or norm, but only when other people in the situation were identified as ingroup others. Similarly, they found that conformity to incorrect judgements about ambiguous stimuli (*Asch's paradigm*; 1956) was a function of group membership; individuals conformed to ingroup member judgements, and resisted conforming to the judgements of those categorised as outgroup members. It is therefore only the ingroup norm that is behaviourally-

relevant and only when one identifies with the group will they assimilate their behaviour to the ingroup norm.

In further demonstrations of this effect, Cruwys and colleagues (2012) found that individuals were influenced by the eating behaviour of ingroup members, but not outgroup members. Participants observed a confederate, who either ate a large or small amount of popcorn and were informed that the confederate shared the same social identity (same university) or was an out-group member (attended a different university). Results showed that modelling of eating behaviour only occurred when the confederate was understood to be an ingroup member. Mackie and Cooper (1984) provided additional evidence of this effect. Participants first completed a pre-test to ascertain their personal views on standardised testing, and two months later were asked to listen to a taped discussion that advocated for either the retention or abolition of these tests. These arguments were then attributed to either a group the participant was about to join (ingroup), or a group with which the participant was to compete with (outgroup). Results showed that individuals shifted their attitudes to be consistent to those expressed in the recordings only when the taped discussion was attributed to an ingroup. In additional supporting evidence, Platow and colleagues (2007) found that participants listening to a comedian with a canned laughter track smiled and laughed significantly more when they were informed the laughter track was recorded with an ingroup audience as opposed to an out-group audience. These results provide support for one of the motivational processes underlying referent informational influence: in situations where the norm is not well-known or established, group members will look to behaviourally relevant others, and use this information as a guide for their own behaviour (Abrams & Hogg, 1990, 2006). As

the results above demonstrate, this effect can be observed across different domains and with differing behaviours.

Research investigating the role of norms in the Theory of Planned Behaviour (TPB; Ajzen, 1991) provides complementary evidence for the role of ingroup norms as an important determinant of behaviour. The TPB considers behavioural intentions to be the most proximal determinant of behaviour. Intentions are in turn, influenced by attitudes towards the behaviour, self-efficacy, and subjective norms; defined as the perception of social pressure from significant others to perform the behaviour. However, research into the proposed role of subjective norms have only found weak correlational support. For example, Ajzen (1991) found that in nineteen separate tests of the TPB, the norm-intention link was non-significant in more than half of the studies, and concluded that personal considerations were therefore more important in determining behaviour. Subsequent assessments of the role of subjective norms in the TPB by Terry and Hogg (1996) and Terry, Hogg, and White (1999), suggest that the consistent lack of support for the role of subjective norms may instead be attributable to the early conceptualisation of subjective norms in that they were tied to significant others, rather than linked to behaviourally-relevant reference groups. Instead, they argued that norms should be conceptualised in line with the Social Identity Approach - that is, they should be conceptualised as the accepted or implied rules that outline how group members should behave, rather than how general others behave.

In a study assessing exercise behaviour, Terry and Hogg (1996) demonstrated direct support for the reconceptualisation of subjective norms to ingroup norms. The perceived norms of a behaviourally relevant reference group (friends and peers at university) influenced intentions to partake in exercise, but only for those who

strongly identified with the reference group. In a second experiment examining sun-protection behaviour with an all-female sample, the results were replicated. The second experiment also demonstrated that perceived ingroup norms were a better predictor of intentions than attitudes, but only for those who highly identified with the group. The reverse was observed for low identifiers; if a person did not strongly identify with the group, attitude towards sun protection was a more reliable predictor of intentions than ingroup norms. This pattern is consistent with the process of self-stereotyping and norm-consistent behaviour under the theory of referent informational influence. When one identifies with a group, and the social identity is salient, ingroup norms will guide behaviour. However, if one does not strongly identify with the group, personal considerations will be a stronger determinant of behaviour.

2.2.5 Social Identity and Proenvironmental Behaviour

The Social Identity Approach offers a theoretical lens through which group dynamics can be investigated. It examines both intergroup behaviour and the process by which one adopts a group identity and conforms to ingroup norms. If we are to extrapolate the findings from the research investigating referent informational influence and the power of ingroup norms and apply it to inform our understanding of proenvironmental behaviour, we can assume that if a social identity is salient, group members will utilise information about the proenvironmental normative stance of the ingroup to guide their own behaviour. Recently, the Social Identity Approach has been applied to examine the group dynamics of proenvironmental behaviour. The following section is dedicated to examining how social identity theoretical insights are relevant to the proenvironmental behavioural domain, and more specifically, whether they can be utilised to influence proenvironmental behaviour.

We examine how social identity insights have been explored in recent research, and we present recent evidence suggesting that the referent informational influence processes can be harnessed to influence proenvironmental behaviour. We then assess the initial evidence base around social identity-informed behavioural interventions in the water domain.

While the Social Identity Approach was originally developed to understand prejudice and intergroup relations, recently researchers have called for a social identity analysis of environmental behaviour (Fielding & Hornsey, 2016; Fritsche, Barth, Jugert, Masson, & Reese, 2017). The Social Identity Approach enables us to understand the important role that our group memberships play in determining our behaviour. This is highly relevant in the environmental domain, especially when we are examining how we can increase our resilience to climate change. For example, responses to climate change are negotiated in group-level contexts (e.g. negotiating blocs at the UNFCC climate change negotiations, such as the Small Island Developing States or the Least Developed Countries), and building a resilient community is only possible if the group (the community) is on board. The Social Identity Approach can also be applied, for example, to enable a deeper understanding of why some individuals support climate change policies, whereas others are vehemently opposed to such action, based on their affiliation to political groups (e.g. Mildenberger, Marlon, Howe, & Leiserowitz, 2017).

Recent empirical insights have demonstrated that the Social Identity Approach can enable a new perspective on environmental challenges. Recent research has provided support for the process of referent informational influence in the proenvironmental domain. Toner and colleagues (2012) found that individuals who received feedback that their individual carbon footprint was higher (worse) than

other ingroup members, were motivated to change their behaviour to align with the group. Feedback from a carbon footprint calculator was manipulated, and participants received either moderately or highly negative feedback in regard to their personal carbon footprint, as well as feedback about the average impact of their own group (fellow university students). Participants expressed higher intentions to behave proenvironmentally when their personal feedback was worse relative to their ingroup. As the effect was not mediated by attitudes, emotions, or self-evaluations, the authors posit that the motivational basis was grounded in a desire to assimilate behaviour to the ingroup norm, rather than personal considerations, in line with the referent informational influence process.

Additional studies have also provided support for referent informational influence in the context of proenvironmental behaviours. In line with social identity processes, once a social identity is made salient, group members will seek to align their behaviour with that of the group (Fielding & Hornsey, 2016). Unsworth and Fielding (2014) examined this process through an investigation into political identity and support for climate change initiatives in Australia. When a political identity is salient, an individual's position on environmental issues may be determined in part by this social identity. For example, substantial heterogeneity in climate change opinions still exist in the US among Democrats and Republicans; while Democrats consistently perceive anthropogenic climate change is occurring and support policy reforms, this belief is less consistent amongst Republican party members (Mildenberger et al., 2017). At an individual-level, this difference has, in part, been attributed to the desire to conform to ingroup norms, and this influence can transcend personal values and beliefs. This is consistent with social identity processes; when a social identity is salient, ingroup members will internalise the ingroup norms, and

their beliefs, attitudes, and behaviour will become those of the group. In the context of a political (social) identity, one would exhibit less support for climate change initiatives if a political identity were salient and their party were not supportive of such measures.

Unsworth and Fielding (2014) demonstrate this effect, whereby right-wing students and community members were less likely to believe in anthropogenic climate change and expressed lower support for climate change policies when their political identity was salient, as opposed to right-wing individuals whose identity was not made salient, and were therefore behaving consistently with personal values and beliefs. Jang (2013) provided further evidence of this effect. When American participants were informed that Americans were excessive energy users (*unsupportive ingroup norm*), they reported less concern about climate change and were less supportive of climate change policy than when they learned that Chinese citizens used excessive energy or received no information at all. This information about the group was utilised to inform and guide behaviour; it provided information on how group members *should* act, and participants behaved accordingly. Consistent with social identity processes, behaviour was guided by perceptions of ingroup norms.

Research from the field of consumer marketing provides complementary evidence that providing group members with ingroup normative information can lead to a shift in behaviour. Although not necessarily guided by the Social Identity Approach, the research provides further support for the basic processes underlying referent informational influence. The research examined the *social labelling approach*; a social marketing tool. When the social labelling technique is applied, a trait is attributed to an individual or group, in an attempt to elicit behaviour that is

consistent with the label (Strenta & DeJong, 1981). Within this area of research, proenvironmental traits were attributed to social groups in a message-based intervention. Post-exposure to the message, group members – of a consumer segment group (Cornelissen, Dewitte, Warlop, & Yzerbyt, 2007) and Americans (Allen, 1982) – behaved consistently with the attributed traits, and selected more sustainable products to purchase, despite the costs of these products being more expensive than alternative products.

Taken together, the evidence outlined in *Chapter 2B* suggests that if we are developing a proenvironmental behavioural change intervention, we would look to the referent informational influence process - which seeks to explain the individual-level cognitive processes that occur when a social identity is salient - to inform an intervention. The referent informational influence process may be harnessed as a behaviour change tool because when a social identity is salient, and an individual identifies with the group, the social identity will form the basis for self-definition; an individual will internalise the group's norms and values and behave accordingly. This is important in the context of a behaviour change intervention, as the individual no longer acts concordant with personal values and norms, but instead, behaves as a stereotypical member of the group. In order to achieve this conformity, individual group members will look for information (consciously or unconsciously) on how group members should behave, and act accordingly. As such, in the context of a social norms messaging intervention, making a social identity salient and providing proenvironmental ingroup normative information, should encourage group members to act consistently with this normative information.

If we re-examine existing research through a social identity lens, we begin to understand the enormous potential social identity insights, and more specifically, the

referent informational influence process, may offer in regard to enhancing the impact of social norms interventions. In an investigation of household energy consumption in California, Nolan and colleagues (2008; as cited in Griskevicius, Cialdini, & Goldstein, 2008) found that the influence of perceived social norms grew stronger the closer and more similar the referent group was to the individual. The decision to conserve energy was most powerfully influenced by the norms of other residents in one's specific community, followed by other people in their city, followed by other Californians generally. In addition, Datta and colleagues (2015) found a similar pattern in their investigation of social norms interventions in Costa Rica. Providing social norms messaging regarding water consumption was effective in influencing behaviour, but only when in was framed in reference to fellow neighbourhood members. When information was provided about other members of their city, the social norms intervention was unsuccessful in eliciting behaviour change. The social identity perspective suggests the effectiveness of these messages relates to the perception that '*others*' who live in one's local community represent fellow ingroup members. While these studies did not set out to integrate a social identity perspective into the intervention, by framing the social norms information in reference to a behaviourally relevant referent group, the experiments may have inadvertently activated the power of group influence outlined by referent informational influence theory. The findings they reached suggest that framing social norms interventions in reference to a behaviourally-relevant group may enhance the effect on behaviour.

Research into proenvironmental behaviour from a TPB perspective shows further support for this premise; it may not be the norms of general others that influence behaviour, but the norms of a behaviourally relevant reference group that really matter. Research into the integration of social identity concepts into

proenvironmental-specific TPB models have demonstrated how focusing on specific proenvironmental referent group norms rather than the expectations and desires of generalised others can increase the model's predictive validity. For example, Terry, Hogg, and White (1999) and Fornara and colleagues (2011) found that perceived ingroup norms predicted intentions to engage in recycling behaviours, beyond standard TPB variables. Similarly, in a sample of farmers, Fielding, Terry, Masser, and Hogg (2008) showed ingroup norms influence intentions to engage in sustainable agricultural practices. Bartels and Onwezen (2014) found that a social identity as an organic consumer correlates with intention to consume sustainable and ethical products, and Fielding, McDonald, and Louis (2008) observed that environmental group membership is a positive predictor of intention to engage in environmental activism.

In these TPB studies, the strength of group membership moderated the effect on behaviour, that is, group membership was likely to influence proenvironmental behaviour when one identified strongly with the group. This finding is consistent with prior research into the Social Identity Approach outside of the environmental domain (e.g. Terry & Hogg, 1996; Terry et al., 1999), and with recent research exploring the role of group identification in proenvironmental behaviour. For example, Masson and Fritsche (2014) found that highly self-invested group members - defined as those who perceived the group to be important and were satisfied with the group - adhered more strongly to climate-related ingroup norms than less self-invested group members. The more one identifies with a group, the more they will align their behaviour with ingroup norms. Masson, Jugert, and Fritsche (2016) found that high identifiers may also perceive their in-group to be more eco-friendly in

comparison to low identifiers, which in turn increases their proenvironmental behavioural intentions.

2.2.6 Climate Resilient Water Behaviour

Recently, research has provided some direct support for the ability of social identity-informed interventions to promote climate resilient water behaviour specifically. Seyranian, Sinatra and Polikoff (2015) employed social identity communication strategies (*see* also Fielding & Hornsey, 2016; Seyranian, 2014) to encourage a reduction in water consumption in a field study conducted in California. Here, proenvironmental behaviour was linked to a social identity, using high levels of inclusive language to portray that acting proenvironmentally is a normative component of '*who we are*' and '*what we stand for*' as a city (p. 85). Seyranian et al. (2015) tested this communication approach against alternative communication strategies (information only; social norms; and personal identity) in a high-water consuming affluent neighbourhood in Los Angeles County.

In the social identity condition, households were provided with a short communication that linked general proenvironmental behaviours to a local city identity ('*Starting from our environmentally friendly architecture to our clean city vehicles and green building programmes, caring for our environment is part of who we are.*'). After outlining information relating to the water scarcity challenges and the city government's water strategy, the communication then included an appeal for residents to contribute by conserving water ('*That's why we need your help – we're asking everyone to contribute for the good of our city'*). Water saving advice was then presented and the communication included a graphic logo of the city and the city name. The message was tested against information only (water saving advice); a social norms condition (socially comparative feedback and supportive injunctive

norms; consistent with Schultz et al.'s (2016) approach); and a personal identity condition, whereby the social identity text was amended to replace inclusive language with individual language ('I', 'you'), and the city logo and name were not included. The key difference between the social norm and social identity condition was the provision of numerical feedback (social norms) and in the social norms condition, neighbourhood norms were made salient, as opposed to a general city-level identity in the social identity condition.

Household water consumption was measured at baseline (pre-intervention) and at one week (short-term) and four weeks (long-term) post-intervention. Controlling for pre-intervention baseline usage, the intervention was found to successfully reduce household water consumption in the social identity, personal identity, and social norms communication condition in comparison to the information-only control. There was no distinguishable difference between the three interventions. Of note, was that behaviour in the information only condition (water saving advice) increased over the duration of the intervention, supporting the notion that providing information alone may not be sufficient to change behaviour. The authors hypothesise that this increase may be attributable to an increase in temperature over the duration of the intervention. The results suggest that a social identity communication offers the potential to motivate a change in residential water behaviour in high-water usage communities and it is efficacious when compared to the provision of water saving advice alone.

Although there was no statistically significant distinction between the effect of the social identity and social norms communication, it is important to note that the manipulations were not a strict test of an *ingroup norms* versus a *general social norms* messaging intervention. In the social norms intervention, general social norms

were presented in reference to neighbourhood others, which may have inadvertently activated a local social identity amongst recipients. Furthermore, the general social norms approach also provided personal consumption feedback, and compared this with feedback on neighbourhood others, thereby introducing social comparative feedback as a potential confound. It was therefore not possible to isolate the effect of providing social norms information or providing social comparative feedback as separate independent determinants of climate resilient water behaviour. Additionally, in the social identity communication developed by Seyranian and colleagues (2015), normative information was provided in reference to the city government, rather than the group members per se. If the referent informational influence process is to be harnessed to its full potential, normative information provided in an intervention should be framed in reference to the targeted ingroup (i.e. residents).

In other evidence, Mallett and Melchiori (2016) recently found that a communication campaign that described members of a university community as *water savers* led to a reduction in showering time and residential water conservation (non-showering behaviours) in the university halls of residence. In the study, a social identity communication campaign was tested against a water efficiency retrofit programme in a 2 (social identity campaign: yes, no) x 2 (water efficiency retrofit: yes, no) design. The social identity campaign included: free message-laden products (toothpaste, dish soap); a water conservation pledge; posters and stickers; and educational programmes. Some of the messages also included an in-group leader, a 'well-known and beloved campus staff member', displaying water conservation behaviour. If messages are presented by ingroup members, they will be perceived as more trustworthy than if the message is attributed to an external source (Abrams & Hogg, 2006). The campaign was delivered at the beginning of the spring semester

and ran for a duration of ten weeks. Water consumption data was collected and participants completed a post-intervention survey.

The results demonstrated that both the social identity and water retrofit programme led to a reduction in water consumption. There was no statistically significant difference between the two conditions. Interestingly, an interaction effect was observed; when the treatments were combined, there was no subsequent change in water consumption in comparison to pre-intervention consumption. The authors attribute this lack of behavioural change to reactance that may occur when an intervention simultaneously targets personal and structural changes.

There are three notable points to consider in the context of developing a social identity-informed water behaviour intervention: 1) the social identity communication campaign was just as effective as a costlier water efficiency device retrofit programme, which suggests that a social identity-based campaign may offer a cost-effective alternative to a retrofit campaign; 2) self-reports and actual water use correlated highly, but only in the social identity condition. The authors attribute this to the campaign being psychologically salient; participants were trying to reduce their water consumption. In comparison, in the retrofit-only condition, a discrepancy between self-reported and actual water use was observed. The authors hypothesised the devices led to water savings without the need for an effort, and they thereby exerted a psychologically invisible effect. In addition, it may be difficult to estimate a reduction in water consumption attributable to a water saving device; and 3) while the social identity message was successful in inducing climate resilient water behaviour, it is not possible to attribute the change in behaviour to the message alone given that different confounds were introduced in the experimental design including: the norm of reciprocity (free toothpaste and dish soap) (Cialdini, 2007); a water

saving commitment (Lokhorst, Werner, Staats, van Dijk, & Gale, 2013); a message from an in-group leader (Hogg, 2001); and educational opportunities (Nieswiadomy, 1992). The two experimental field trials do highlight that there is a strong potential for campaigns informed by social identity insights to motivate climate resilient water behaviour.

While this initial evidence is encouraging, if we are to utilise social identity insights to enhance social norms interventions in the context of climate resilient water behaviour, it is crucial that we develop a proper understanding of *how* and *why* such an approach can work. In Seyranian and colleagues (2015) study, normative information was provided in reference to the city government, rather than group members per se. Congruent with the referent informational influence process, a social identity-informed intervention will be most influential when norms are framed in reference to the targeted ingroup, in this case, city residents. In Mallet and Melchiori's (2016) study, due to multiple treatments being applied throughout the intervention, it was not feasible to determine a causal link between the observed behaviour change and the social identity-informed message.

The empirical examples and demonstrations of industry-led applications of social norms-based approaches demonstrate that these techniques can offer an avenue to encourage climate resilient water behaviour and as such, should be considered as a valuable addition to WDM strategies. However, given the importance of developing effective strategies to engage water end-users, it is crucial that these approaches are maximally effective. Drawing on social identity insights may provide a promising avenue to extend and optimise social norms-based interventions. As Social Identity scholars confer, normative information should be more influential when it is framed in reference to a behaviourally-relevant ingroup,

rather than general others (Abrams et al., 1990; Turner, 1982). Two recent studies in the residential water domain (Seyranian et al. 2015; Mallet & Melchiori, 2016) provide initial evidence that social identity informed approaches can indeed encourage resilient water behaviour. The mechanism by which a social identity-informed intervention should be influential is the referent informational influence process; when a relevant social identity is salient, group members will look to the norms of the group to guide their behaviour (Abrams et al., 1990). However, this process – and an appeal which specifically harnesses this process – has not been previously investigated. In the Seyranian et al. (2015) study, the appeal referenced the norms of the city government, rather than city residents, and provided examples of general proenvironmental behaviours rather than resilient water behaviour norms. Mallet and Melchiori's (2016) study also demonstrated that a message-based intervention informed by the Social Identity Approach could be utilised to encourage behaviour change, yet given the different interventions that were implemented in unison, it was not possible to draw causal inferences.

This thesis aims to test a social identity-informed message on climate resilient behaviour. Specifically, it will draw on the referent information influence process and communicate that water conservation is normative of the target ingroup. This body of research will aim to examine a social identity-informed message as a single treatment, thereby enabling causal inferences to be observed. In addition, this research will examine the mechanisms underlying the effect of the intervention on behaviour (mediating and moderating variables), thereby further extending prior research. This thesis will provide a comprehensive evaluation of an ingroup norms messaging approach in the context of climate resilient water behaviour to determine whether and when this approach has the power to elicit behavioural change.

Specifically, the ingroup norms appeal will seek to make a relevant social identity salient and then tie climate resilient water behaviour to this identity by stressing that this behaviour is ingroup normative and defines and characterises the group identity, thereby harnessing the referent informational influence process. The ingroup norms appeal will be examined across five studies.

Summary and Conclusions

Chapter 2B demonstrated that there is the potential to harness insights from the Social Identity Approach to enhance social norms interventions and encourage behaviour change. Under the referent informational influence process - the theory of group influence under the Social Identity Approach - social influence is driven by membership to a social group. Because ingroup norms are internalised as part of one's self-concept, when a social identity is salient, group members will seek to conform to the norms of the ingroup. Empirical evidence suggests that this this process can be utilised in an intervention to influence behaviour.

Chapter 2B outlined empirical evidence demonstrating that if a social identity is salient, and ingroup normative information is presented in an intervention, group members will utilise this information to guide their behaviour. The research presented within *Chapter 2B* also demonstrated that this process can also be translated to encourage behaviour change within the proenvironmental domain. Promisingly, two previous studies highlight that there is potential to apply social identity insights to encourage climate resilient water behaviour. What is now required is a comprehensive empirical examination of *whether* and *when* a social identity-informed intervention, harnessing the influence of the referent informational influence process, can motivate climate resilient water behaviour.

Aims of the Thesis

Global water scarcity is only set to exacerbate with a changing climate and environmental conditions and a rapid increase in water demand. This thesis aims to provide an examination of whether social identity-informed solutions can be integrated into the demand management tool-kit that is required to ensure fresh water availability is not compromised and our finite resources are used sustainably. A social identity-based perspective may offer new insight into developing more effective and better-targeted behaviour change interventions. Existing research, outlined in *Chapter 2A* demonstrated the power of normative messages for encouraging proenvironmental behaviour (e.g. Allcott, 2011; Nolan, Schultz, Cialdini, Goldstein, & Griskevicius, 2008; Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007), and water conservation behaviour specifically (e.g. Fielding et al., 2013; Richetin et al., 2016; Schultz et al., 2016). However, we expect that only providing general information about others' behaviour in social norms interventions will be sub-optimal. Based on insights from the Social Identity Approach outlined in *Chapter 2B*, we predict that social norms messages will be even more influential when they are tied closely to salient group memberships and climate resilient water behaviour ingroup norms are communicated. The research findings outlined in *Chapter 2B* suggest that there is potential to apply social identity insights to encourage climate resilient water behaviour and inform behavioural interventions in the residential water domain.

Considered together, the extant literature suggests that applying insights from the Social Identity Approach may offer a valuable contribution to proenvironmental behavioural research, and more specifically, encourage climate resilient water behaviour in the residential water domain. Drawing on the process of referent

informational influence, we see that rather than communicating the norms of general others, social norms messages should communicate the norms of a behaviourally relevant group; it may not be information about *general others* that matter in these interventions, it is information about the behaviour of *relevant* others. Given the importance of finding solutions to the water challenges we face and the crucial role of behavioural-based approaches in this process, it is crucial that we investigate whether social identity insights, and more specifically, the power of ingroup norms, can be drawn upon to encourage climate resilient water behaviour.

The first aim of this thesis is to expand the emerging evidence base while providing a more complete examination of social-identity based interventions than demonstrated by previous research. This thesis will focus on behavioural intentions and actual behaviour, with multiple participant populations and examine mediating and moderating factors. In addition, collaboration with industry partners is undertaken, to ensure the research is contextually relevant and there is potential for impact.

In order to develop effective evidence-driven solutions that can be applied on the ground, it is becoming increasingly important for researchers to partner with practitioners to ensure that the theory-practice bridge is crossed. We partner with the water utility company in the East of England, a business water supplier, and a university to test our approach and examine whether it has the potential to motivate climate resilient water behaviour. In doing so, we aim to investigate whether social identity insights can be harnessed to motivate climate resilient water behaviour and inform demand management strategies. This collaboration also enables a real-world test of an ingroup norms appeal, which Kahan and Carpenter (2017) posit is crucial

if behavioural science insights are to inform potential solutions to our most pressing environmental challenges.

UK-context. This research was conducted in Norfolk in the East of England. Although most of the empirical evidence around testing water conservation interventions emanate from water scarce regions in the US and Australia, the UK is not exempt from water scarcity issues. Despite popular perceptions of abundant freshwater resources, the East of England in particular is prone to drought and is classed as being water stressed (Cook, 2016; Department for Environment Food and Rural Affairs (Defra), 2011). The region is the driest in the UK and water demand is expected to rise; it is one of the fastest growing regions in the UK. There is a projected increase of 34 percent of new households in the region by 2031 (Anglian Water, 2015a). Despite these projections, there is potential to achieve water savings. In the East of England, average daily water consumption is 145 litres per person (Anglian Water, 2016), slightly less than the national average of 150 litres per person per day (Consumer Council for Water, 2015). Anglian Water, the region's water utility company, aims to reduce this to 80 litres per person per day (Anglian Water, 2017a). This will require extensive efforts to reduce residential water demand.

Water challenges are not constrained to the eastern region of England; the release of the WWF Update (June 2017) suggests that over half of the chalk streams and almost a quarter of all rivers in England are at risk of drying out. By the 2050s, many catchments across the UK will need to manage water deficits (UK Committee on Climate Change, 2017). Climate change will further exacerbate existing water stress; the UK's 2017 Climate Change Risk Assessment recognises water shortages as one of the greatest climate-change related threats to the UK and severe water

supply deficits are projected by 2050 with conservative climate change scenarios (Committee on Climate Change, 2016).

Novel Approach to Encourage Climate Resilient Water Behaviour. The intervention approach we develop and test throughout this thesis aims to promote water saving efforts through the provision of ingroup norms. Specifically, the ingroup norms appeal seeks to make a relevant social identity salient (e.g. a local region, city, or community), and then to tie water conservation efforts to this social identity by stressing that this behaviour is ingroup normative and defines and characterises the group identity. Across five studies, we provide a comprehensive test of whether messages promoting ingroup norms favouring climate resilient water behaviour encourage behaviour change.

The investigation is organised around five central questions:

1) Is an ingroup norms appeal more effective than information-only or a no-treatment control in encouraging climate resilient water behavioural intentions? (*Chapter 3; Study 1*);
2) Is the effect of an ingroup norm appeal on climate resilient water behavioural intentions mediated by a change in perceived ingroup norms? (*Chapter 3; Study 2*);
3) Is the effect of the ingroup norm appeal on climate resilient water behavioural intentions moderated by group identification? (*Chapter 4; Study 3*);
4) Is an ingroup norms appeal more effective than a general social norms appeal in encouraging a habitual climate resilient water behaviour? Do the normative interventions lead to positive behavioural spillover? These

questions are examined in a randomised control field trial, in collaboration with industry partners (*Chapter 5; Study 4)*;

5) Can the ingroup norms appeal be utilised by a water utility company to encourage a one-off climate resilient water behaviour in a water scarce region in the East of England? This question is examined in a large-scale experimental field trial (*Chapter 5; Study 6)*

We then consider the implications of these findings on our understanding of proenvironmental behaviour and developing evidence-based and research-driven strategies to address water challenges (*Chapter 7*).

3 Can an Ingroup Norms Appeal Encourage Climate Resilient Water Behaviour?

Previous research examining the Social Identity Approach suggests it may be effective to frame social norms communications in reference to a behaviourally relevant group - one's ingroup. In Study 1, we examine whether an ingroup norms message can encourage climate resilient water behaviour. We find that an ingroup norms appeal is more effective than an information-only or a no-treatment control in encouraging climate resilient water behavioural intentions. In Study 2, we investigate the mediational role of ingroup norms. We find that the effect of an ingroup norms appeal on behavioural intentions is mediated by a change in perceived ingroup norms surrounding water conservation. We also examine the role of potential covariates (rainfall-salience on the day of the study and baseline perceptions of water scarcity in the region). Together, these studies provide the first strict test of the ingroup norms appeal, and its mediating mechanism, in the context of climate resilient water behaviour and contribute to the emerging evidence base.

3.1 Introduction

Ensuring adequate freshwater availability for human and environmental needs is one of our most pressing global challenges (Eliasson, 2015; Kummu et al., 2016; Taylor & Sonnenfeld, 2017). One approach to address this challenge is to encourage a reduction in water demand. This strategy will become exceedingly important in the domestic sector, where it is projected there will be a surge in global demand of 30 percent by 2050 (OECD, 2012). As outlined in *Chapter 1*, the most widely utilised

strategy to engage the domestic sector in industrialised economies is a large-scale communication campaign (Howarth & Butler, 2004; Syme et al., 2000). These campaigns generally provide information about water challenges and water saving advice through the medium of: direct mail-outs; community billboards; radio, newspaper or television commercials; or more recently, online appeals. Traditionally, these have been developed around the assumption of a *knowledge deficit*, that is, suboptimal behaviour occurs only due to a lack of knowledge or awareness (Burgess et al., 1998; Schultz, 2002). It is therefore assumed that providing the appropriate information to fill this knowledge gap should result in behavioural change. However, the variables that determine our behaviour are far more complex; although knowledge is an important prerequisite - if we do not feel saving water is warranted, we will be unlikely to make an effort to do so - on its own, it may be insufficient to incentivise climate resilient water behaviour.

3.1.1 Social Norms Messaging and Water Behaviour

In *Chapter 2A*, we saw that recent insights around climate resilient water behaviour have demonstrated that integrating social norms information into a campaign can enhance its effectiveness. Social norms refer to a set of beliefs about what most others do, or approve of doing in a given context (Cialdini & Trost, 1998). In a message-based intervention, rather than providing information regarding water challenges or water saving advice, it may prove effective to provide information that the majority of others are saving water (descriptive norm), and/or approve of doing so (injunctive norm). In both the research and practitioner domains, social norms messaging is increasingly recognised as an effective tool to incentivise behavioural change. Schultz and colleagues (2016) recently demonstrated that providing socially comparative feedback - providing information about the use of

other households water consumption as well as personalised feedback - led to a reduction in residential water consumption compared to a no-treatment control and information-only condition in drought-prone California. Similar findings were observed in Fielding and colleagues (2013) study in a water scarce region in Australia; providing social norms information outlining the water saving behaviour undertaken by water efficient households and providing personalised feedback led to a reduction in water consumption. Richetin and colleagues (2016) further demonstrated that it is possible to target specific water behaviour (turning off the tap while lathering hands) in a social norms message-based intervention.

Examples from industry also show there is promising potential to apply social norms interventions to encourage large-scale behaviour change. Empirical studies from WaterSmart in the US, and Advizzo, a UK-based firm, demonstrate that providing socially comparative feedback, personalised feedback, and water saving advice to residents in direct-letter mail-outs led to an average reduction of total residential water consumption of 5.6 percent in California (Mitchell & Chesnutt, 2013) and 2.2 percent, in the UK (Hinton, 2017). What is particularly promising about this approach is that these savings were achieved without the need for costly infrastructural change, nor sweeping regulatory change, suggesting that social norms interventions can offer a valuable contribution to demand management strategies.

3.1.2 Harnessing the Referent Informational Influence Process

Insights from research into the Social Identity Approach suggest that one avenue to increase the efficacy of social norms interventions is to frame the norms in reference to a behaviourally relevant reference group. Under the Social Identity Approach, when a social identity is salient, group members undergo a process of *depersonalisation*. That is, group members view themselves in terms of the defining

attributes of the group, and assimilate their perceptions, emotions, attitudes, and behaviour to that of the ingroup stereotype (Hogg & Turner, 1987; Turner, 1985); they internalise the group's norms as their own.

The theory of *referent informational influence* (Hogg & Turner, 1987; Oakes, Turner, & Haslam, 1991; Turner, 1982) posits that when a salient social identity is activated, if an ingroup norm is not widely established, group members will look to ingroup others or alternatively, credible sources of information to ascertain the ingroup norms (Abrams & Hogg, 2006). For example, in the case of Terry, Hogg, and McKimmie's (2000) two experiments around psychology-specific career choices and ingroup (jury) decision-making participants adhered to newly provided information about ingroup norms when the ingroup normative position had not been previously established. This is noteworthy, as these findings demonstrate that it is possible to provide new ingroup normative information in an intervention, and for group members to subsequently internalise these norms and act consistently with this new information.

Findings surrounding the TPB provide further complementary evidence for the utility of an *ingroup* normative approach in the context of a behaviour change intervention. Social identity scholars (Terry & Hogg, 1996; Terry, Hogg, & White, 1999) argue that the proposed role of subjective (social) norms in the TPB had only weak correlational support (Ajzen, 1991; Armitage & Conner, 2001), as, it should instead be the norms of *ingroup* others, not significant others, that determine behaviour. This reconceptualisation of *social norms* to *ingroup norms* was supported in correlational research examining the TPB in different contexts, including exercise and sun protection behaviour (Terry & Hogg, 1996).

3.1.3 Evidence of the Utility of Proenvironmental Ingroup Norms Messages

The role of ingroup norms as a behavioural determinant within the proenvironmental domain has recently been examined. Unsworth and Fielding (2014) demonstrated that when one's right-of-centre political identity was made salient, they were less likely to support climate change policies; consistent with the Australian right's ideological stance (ingroup norms). When participants' social identity was not made salient, they behaved consistently with personal values and beliefs. Jang's (2013) research corroborates this; when it was communicated to participants that their ingroup (Americans) were excessive energy users, they were more likely to behave consistently with this attribute; stating that they were less concerned about climate change and less supportive of climate change policies, in comparison to participants who learned that Chinese citizens used excessive energy or those in a no-treatment control condition.

Under the referent informational influence process, group members internalise and adhere both to established ingroup norms (e.g. ideological stance on climate change policies; Unsworth & Fielding, 2014), as well as newly communicated ingroup normative information, as demonstrated by Jang (2013) (e.g. 'Americans are excessive energy users'). As such, it may be possible to attribute a climate resilient water behaviour identity to a group that is not defined by, nor possesses, any existing proenvironmental tendencies. This would enable an ingroup norms appeal to be widely implemented across diverse social groups, as opposed to only those with pre-existing proenvironmental inclinations. If the ingroup norms appeal is to be utilised at a large-scale, it is important to establish whether climate resilient water

behavioural norms can come to characterise and influence the behaviour of a group that is not inherently defined by proenvironmental attributes.

Promisingly, as reviewed in *Chapter 2B*, recent evidence suggest that social identity insights can be directly applied within the water domain. Seyranian et al. (2015) found that linking a city-identity to general proenvironmental behaviours undertaken by the local government and providing water saving information and advice in a message-based intervention led to a reduction in household water consumption in California (in comparison to a pre-intervention baseline). While this study provided initial evidence of the efficacy of a social identity intervention on climate resilient water behaviour, it did not provide a strict test of an ingroup norms appeal. To optimise the influence of the referent informational influence process, the intervention should communicate the norms of the ingroup (i.e. residents), rather than the norms of the city-level government. Thus, it is important to further refine and test an ingroup norms appeal approach in the context of climate resilient water behaviour.

Mallet and Melchiori (2016) also observed an effect of a social identity intervention in a university residence in the US over a ten-week period. A social identity communication campaign was tested against a water efficiency retrofit programme in a 2 (social identity campaign: yes, no) x 2 (water efficiency retrofit: yes, no) design. Based on water consumption data, both the social identity campaign and the retrofit programme (as single treatments) led to a reduction in water consumption. Promisingly, there was no statistically significant difference between the two interventions, demonstrating that water savings could be achieved with a social identity campaign and this did not require any additional costly infrastructure, as per the retrofit programme. However, it was not possible to isolate the effect of

the social identity message as additional treatments (e.g. making a personal commitment to save water; educational opportunities; free products) were implemented in conjunction with the message. These initial findings demonstrate the potential of a social identity-informed intervention to encourage climate resilient water behaviour. More research is now needed to refine the ingroup norms appeal and isolate the effect of the intervention on climate resilient water behaviour.

3.1.4 Current Research

This research extends initial findings in several important ways. Firstly, a more refined intervention is developed that a) specifically communicates the behaviour of other ingroup members (rather than local government; Seyranian et al. (2015)); and b) removes other persuasive elements, so it is possible to isolate the effect of the intervention on behaviour. This intervention is tested across two samples: university students (*Study 1; UEA student identity*), and members of the general public in the Norwich, a city in the East of England (*Study 2; Norwich resident identity*). These social identities were selected as they were relevant to the entire sample, yet were also the most proximal (i.e. *Norwich resident* rather than *UK resident*). Congruent with the Social Identity Approach, the more proximal the identity is, the more influential it will be (Hogg & Reid, 2006; Tajfel & Turner, 1986). In *Study 1*, this intervention is tested in comparison to providing only information or a no-treatment control, and in *Study 2*, we then go on to examine a mediating mechanism underlying the effect of an ingroup norms message: a change in perceived ingroup norms; congruent with the theory of referent informational influence. It is hypothesised that:

H1: An ingroup norms appeal will be more effective than an information-only or a no-treatment control in encouraging water conservation intentions (*Study 1*); and

H2: A change in perceived ingroup norms will mediate the effect of the ingroup norms appeal on water conservation intentions (*Study 2*).

3.2 Study 1

Study 1 investigated the efficacy of the ingroup norms appeal. It compared the effectiveness of the approach against two control conditions – an information-only control and a no-treatment control. The information-only control allowed the effects of receiving information about the importance of saving water to be separated from the effects of social information that suggests this behaviour is normative of one's social group (ingroup norms appeal). The no-treatment control served as a baseline and a test of the effectiveness of information provision alone.

3.2.1 Participants and Design

A total of 143 participants were recruited from a public square at a university in the East of England over two consecutive days. The sample consisted of 100 females and 43 males, aged between 18 and 44 (M = 21.82, SD = 4.17). No exclusions were made. Participants were randomly assigned to one of three conditions in a between-subjects design: ingroup norms appeal condition (n = 46), information-only (n = 50), or no-treatment control (n = 47). Responses were collected via pen-and-paper-based questionnaires.

3.2.1.1 Pilot study

To develop the ingroup norms appeal, a pre-test was first conducted (n = 40) at the university to ascertain which climate resilient water behaviours were considered to be most ingroup normative. The pilot study was conducted prior to the main study and run with different participants. In the pilot study, participants were presented with 19 climate resilient water behaviours, adapted from water saving information provided by a water saving advice website (Water Use It Wisely, 2016) and advice on the website of the region's water utility company (Anglian Water, 2013). They rated how frequently they performed the behaviour (on a scale from 1 *not at all* to 7 *always*); how often others around them performed the behaviour (on a scale from 1 *not at all* to 7 *always*); how effective the behaviour was in reducing their individual consumption (on a scale from 1 *not at all effective* to 7 *very effective*); and self-efficacy, or how easy it was to perform the behaviour (*If I wanted to, I could in most instances…*; on a scale from 1 *extremely unlikely* to 7 *extremely likely*) (adapted from Van der Werff, Steg, & Keizer, 2014). These results were used to inform the example water behaviours included in *Study 1* and *2*. In *Study 1*, examples of general water behaviours were selected (e.g. saving water in the kitchen, bathroom, and while washing clothes) and in *Study 2*, specific behaviours were selected that were perceived to be: performed frequently; effective; and not difficult to perform (*see* Table 1). These behaviours (general and specific) were selected as they would serve to convincingly highlight ingroup normative behaviour. To reduce the risk of a ceiling effect, and determine if the intervention was influential, behaviours that were not as frequently performed were selected as post-intervention behavioural intentions items (*see* Table 1 for selected behaviours).

Table 1 Pre-test Means and Standard Deviations of: Frequency (Personal; Others); Efficacy (Water Saving Impact); and Self-efficacy

Climate resilient water behaviour	*M (SD)* Frequency (Personal)	*M (SD)* Frequency (Others)	*M (SD)* Efficacy (Impact)	*M (SD)* Self Efficacy
Shorten shower duration by one or two minutes to save water *	2.80 (2.02)	2.85 (1.78)	4.65 (1.63)	5.80 (2.02)
When using a dual flush toilet, use the half-flush when appropriate	4.85 (2.08)	3.65 (1.50)	5.05 (1.50)	6.10 (1.71)
Scrape dishes rather than rinsing them before washing	4.70 (2.08)	4.25 (1.55)	4.55 (1.87)	5.85 (1.93)
Soak pots and pans instead of letting the water run when scraping clean*	4.45 (1.76)	4.90 (1.59)	5.35 (1.46)	5.80 (1.61)
When washing hands, turn off the water to later *	2.95 (2.11)	2.85 (1.46)	4.65 (1.78)	5.90 (1.68)
Turn off the tap when brushing teeth*	5.70 (1.86)	4.35 (1.93)	5.80 (1.28)	6.55 (1.47)
Turn off the water when washing hair in the shower	1.95 (1.43)	1.95 (1.54)	5.05 (1.64)	4.85 (2.16)
When washing dishes, fill the sink or a container, rather than letting the tap run*	4.75 (2.53)	4.20 (2.09)	5.35 (1.66)	5.75 (1.94)
Keep time in the shower to less than five minutes*	3.50 (1.70)	3.10 (1.59)	6.00 (1.64)	4.40 (2.11)
Set the shower pressure to a low, or medium, rather than a high level*	2.65 (1.84)	2.35 (1.42)	4.70 (1.34)	4.85 (1.69)
Cook food in as little water as possible*	3.80 (1.79)	3.65 (1.50)	4.10 (1.62)	5.90 (1.55)
Wash vegetables in a bowl, not under a running tap	2.15 (1.60)	2.35 (1.42)	3.85 (1.95)	5.65 (1.69)
Wait until there is a full load of washing before beginning a wash cycle *	6.03 (1.58)	4.72 (2.01)	6.27 (0.96)	6.20 (1.34)
Turn off the tap if you see it hasn't been properly shut off *	6.85 (0.53)	5.30 (1.88)	6.25 (1.24)	6.50 (1.45)

Note: *Behaviours included in the message (Study 2) are highlighted in bold. Those included in the post-intervention surveys are denoted with an asterisk.*

3.2.2 Procedure

Following the informed consent process, participants were presented with the experimental manipulations. Participants in the information only condition were presented with a short text urging the importance of saving water around the home. The intervention text was adapted from an online water conservation information campaign developed by the region's water utility company. A later collaboration with the utility was planned, so it was ensured that any experiments testing the approach would be developed with reference to their existing consumer engagement materials. This also enabled a stricter test of the ingroup norms appeal versus a traditional information-only appeal utilised within the water industry. Specifically, participants in the information-only condition read (*see* Appendix A for complete survey):

> *Save Water. Although water may seem abundant, fresh water is a limited resource. You can do your bit to save water around the house - in the kitchen, in the bathroom, and while washing clothes.*

There were therefore two components to the information-only appeal: 1) why water saving is important; and 2) water saving advice. This was consistent with the water utility's existing consumer engagement campaign the region and with information-only interventions tested in earlier water behaviour studies (e.g. Fielding et al., 2013; Schultz et al., 2016; Seyranian et al., 2015).

In the ingroup norms appeal condition, this same information was augmented with ingroup normative information. The university group (students at the University of East Anglia (UEA)) represented the referent group for the normative manipulation. This social identity was selected as the experiment was conducted on

university grounds and was anticipated to be a social identity that was relevant to all participants while also being a proximal social identity, as opposed to a broader category, such as English, or British. Social identity scholars have posited that the more proximal a social identity is to the self, the more influential it will be in determining behaviour when the social identity is salient (Hogg & Reid, 2006; Tajfel & Turner, 1986), and recent experimental insights support this notion (Datta et al., 2015; Griskevicius et al., 2008).

In the intervention, the social identity was made salient by referring to the social group (*UEA Students*) and a graphic logo related to the university was also included to increase the salience of this group identity (*see* Seyranian, 2014; Seyranian et al., 2015). Climate resilient water behaviour was directly attributed to the social identity ('*As UEA students, saving water and caring for the environment is part of who we are'*). The intervention text urged the importance of saving water (the *why*), and new ingroup normative information was then offered; the message communicated climate resilient water behaviour was ingroup normative and embedded in the university student identity. This communication of ingroup normative information is consistent with prior methodological approaches whereby new information regarding an ingroup normative position is communicated, and group members act consistently with this new attribution (e.g. '*Americans are excessive energy users'*; Jang (2013)).

The text was developed to incorporate both injunctive and descriptive supportive norms, consistent with findings from prior research (e.g. Cialdini, Kallgren, & Reno, 1991; Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007) demonstrating that the influence of social norms messaging can be enhanced if

injunctive norms (what the ingroup is *supposed* to do) and descriptive norms (how the ingroup *actually* behaves) are both positive and supportive of the targeted behaviour, in this case, climate resilient water behaviour. It was therefore communicated that water saving was an important and valued part of the group's identity (*injunctive ingroup norm*) and provided general descriptive normative information; informed by the pilot test. These served as descriptive examples of ingroup behaviour. Specifically, participants in the social identity intervention condition read:

> *UEA Students Save Water. Although water may seem abundant, fresh water is a limited resource. As UEA students, saving water and caring for the environment is part of who we are. We're proud to be water savers and we do our bit to save water around the house – in the kitchen, in the bathroom, and while washing clothes.*

Participants in the no-treatment control condition did not read any information but went immediately on to complete the dependent measure. The dependent variable was participants' intentions to engage in water conservation. Participants indicated how likely they were to engage in various water-saving behaviours over the next few weeks (from 1 = *not at all likely* to 7 = *very likely*). Behaviours included: 'Turn off the tap when brushing teeth'; 'Whenever possible, set the shower pressure to a low, or medium, rather than high level'; 'When washing dishes, fill the sink or a container, rather than letting the tap run'. These items were informed by the pre-test and recognised as being effective approaches which were unrestrained by context (e.g. it did not matter if respondents had a garden or not or

were able to install water efficient devices or not). Items were combined into a composite index of behavioural intentions (α = .66).

To conclude the experiment, participants provided demographic information and completed a three-item rainfall-salience score with the items: 'Is it currently raining?', 'Has it rained today?', and 'Do you expect it to rain today?' (*Yes, No, Unsure*). Perceptions of adequate freshwater availability, for example, a region receiving adequate rainfall to meet water demand, may alter (reduce) perceptions of the need to save water (Hassell & Cary, 2007; Lowe, Lynch, & Lowe, 2014). If one were completing the survey and had either experienced rain that day, or perceived rain to be imminent, this may alter perceptions of freshwater availability, and thus, the need to act to save water. Therefore, rainfall salience was measured and controlled for as a potential covariate. Participants were then thanked and debriefed.

3.2.3 Results

A univariate ANOVA tested the difference in water saving intentions between conditions. A significant omnibus effect was observed, $F(2,140) = 10.61$, $p < .001$, $\eta^2 = .13$. Intentions followed the predicted step-wise trend. Pairwise comparisons with a Tukey adjustment revealed that intentions were significantly higher in the ingroup norms appeal condition ($M = 5.28$, $SD = 0.85$) compared to the no-treatment control condition ($M = 4.48$, $SD = 0.91$), $Mdiff = 0.79$, 95% CI [0.38, 1.20], $p = <$ .001, and marginally higher than the information-only condition ($M = 4.90$, $SD =$ 0.73), $Mdiff = 0.38$, 95% CI [-.02, 0.78], $p = .068$. Intentions were also significantly higher in the information-only condition compared to the control condition, $Mdiff =$ 0.41, 95% CI [0.01, 0.81], $p = .041$ (*see* Figure 5).

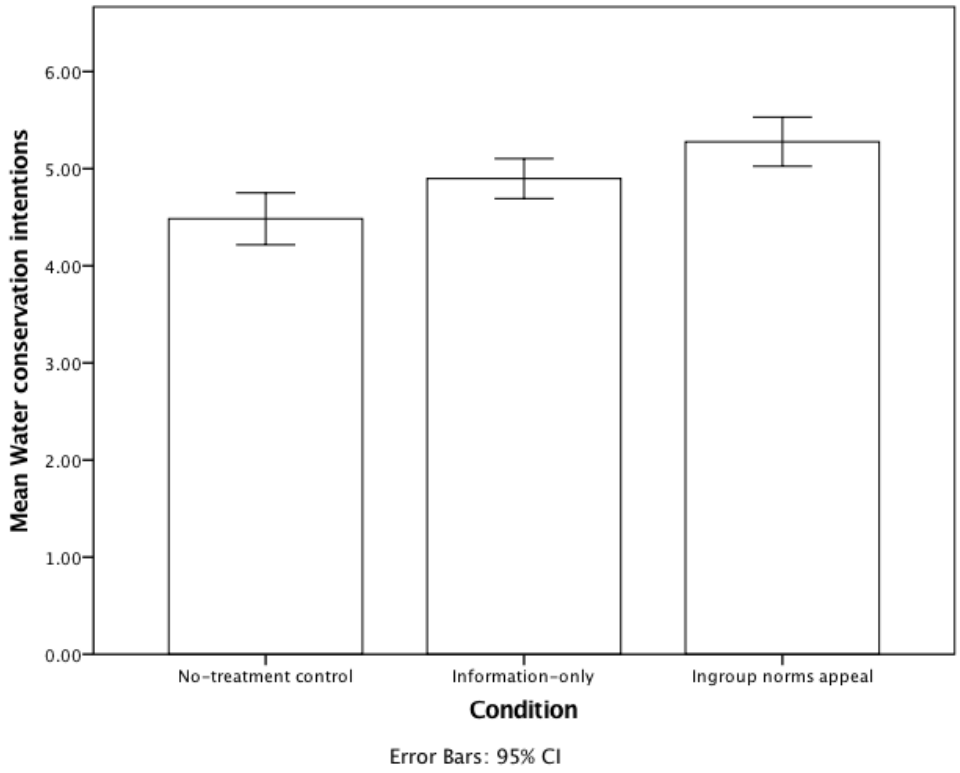

Figure 5 Mean water conservation intention scores across the three conditions: no-treatment control; information-only; and ingroup norms appeal

3.2.4 Supplementary analysis

A rainfall-salience score was calculated for the three items: 'Is it currently raining?', 'Has it rained today?', and 'Do you expect it to rain today?' (*Yes; No; Unsure*). All '*Yes*' responses were recoded for a score of 1, and all other responses were recoded 0. The final rainfall-salience score was a sum score of the three questions. An ANCOVA was conducted in which the rainfall-salience score was included as a covariate. After adjustment, there was still a statistically significant difference in water behaviour intentions between the interventions $F(2,139) = 10.93$, $p < .001$, $\eta^2 = .14$. The rainfall-salience score was not a statistically significant covariate ($p = .111$).

3.2.5 Discussion (Study 1)

Study 1 provided initial evidence for the efficacy of a social identity-based behavioural intervention by comparing the effectiveness of an ingroup norms appeal to an information-only and no-treatment control. We do find evidence that providing information about the importance of saving water increased intentions to do so compared to baseline. Although the difference between the information-only condition and the ingroup norms appeal was only marginally statistically significant, the general trend suggests it was even more effective to frame this information as being normative of one's social group (in this case, other students at the participant's university). By making a relevant social identity salient, and framing water conservation as being ingroup normative, ingroup members sought to align their behaviour with the salient identity and associated norms, consistent with a social identity-based process (Hogg & Turner, 1987; Turner, 1982). Effects persisted after controlling for rainfall-salience score on the day of the study.

3.3 Study 2

According to the Social Identity Approach, the process through which representations of the ingroup (e.g. norms, stereotypes) become the basis for behaviour is *internalisation*; people internalise the norms and values of the groups they belong to by incorporating that social identity as an aspect of their self-concept (Tajfel & Turner, 1986; Turner et al., 1987). If people learn a normative attitude or behaviour of the ingroup, they will be inclined to agree with it, as good group members 'should', and will use this normative information as a cue to guide their own behaviour. This framework suggests our intervention approach is effective because it increases perceptions of ingroup norms surrounding climate resilient

water behaviour, which then subsequently act as a guide for individual's behaviour as a group member. *Study 2* sought to provide an empirical test of this hypothesis. It is the first test of ingroup norms as a mediating variable in the context of climate resilient water behaviour. It was expected that changes in individuals' behavioural intentions due to the intervention would be mediated by changes in perceived ingroup norms.

3.3.1 Participants and Design

Members of the public were approached in the centre of Norwich, a city in the East of England. A total of 126 volunteers were recruited over a two-day period. The referent group for the experimental manipulation was the residential city. This identity was selected as, consistent in *Study 1*, this social identity was relevant to all participants and was the most proximal social identity that would apply to all participants. Participants were asked to confirm that they lived in Norwich before beginning the survey. Two participants were removed from the analysis because they were not city residents. The final sample consisted of 124 individuals which included 62 females and 62 males aged between 18 and 86 (M = 40.07, SD = 15.74). Having established the effects of the intervention in comparison to an information-based campaign in *Study 1*, the design was refined in *Study 2* to focus only on the comparison between the intervention condition and a no-treatment control. Participants were randomly assigned to either the intervention condition (n = 63) or the control condition (n = 61) in a between-subjects design.

3.3.2 Procedure

Participants first completed two items to ascertain existing perceptions of water availability and stress: 'The East of England has abundant water resources'

and ‘The East of England can experience conditions of drought’ (from 1 = *strongly disagree* to 7 = *strongly agree*). In the UK, baseline perceptions of water stress may be lower than those in California or Australia. Syme et al. (2000) posit that if residents do not perceive there to be pressure on water resources, it may lead to less engagement with climate resilient water behaviour interventions, as residents do not perceive there to be a need to engage. These questions therefore enable insight into: a) whether there is a perception of water stress; and b) if not, whether the intervention is still effective in encouraging climate resilient water behaviour.

Participants in the experimental condition were then presented with the intervention text, adapted from that used in *Study 1* with several refinements. Specifically, the text was expanded by including several specific examples of water-saving behaviours. Behaviours included: waiting until there is a full load of washing before beginning a wash cycle; turning off taps if they haven’t been shut off properly; and turning off the tap when brushing teeth (*see* Table 1). This information was then also reinforced by a quote ostensibly from a local resident, expressing their support for water conservation efforts. The quote was adapted from consumer engagement materials developed by the region’s water utility company. To help incentivise participation, participants were also given a free magnet that displayed a cartoon water droplet figure and the message ‘*Norwich Saves Water*’. Participants in the no-treatment control condition also received a free magnet which contained just the illustration and no message.

All participants then completed the dependent variables. Perceived ingroup norms were measured with four items, including ‘Members of the Norwich community think that saving water is important’, and ‘Most members of the Norwich community try to conserve water’ (from 1 = *strongly disagree* to 7 = *strongly agree,*

α = .86). Following the norms items, six items measured participants' intentions to engage in water conservation behaviours in future.

Items were adapted from *Study 1*. Participants indicated on a seven-point scale how likely it was that they would perform each behaviour over the next few months (from 1 = *not at all likely* to 7 = *very likely).* To reduce the possibility of experimental demand bias, behaviours specifically mentioned in the experimental text were not included. New items included: 'Try to cook food with as little water as possible' and 'Try to soak pots and pans instead of letting water run when washing dishes' (α = .86). To conclude the experiment, participants provided demographic information; completed the three-item rainfall-salience score; and were thanked and debriefed (*see* Appendix B for survey).

3.3.3 Results

In line with predictions, an independent samples *t*-test confirmed that water conservation intentions were significantly higher in the ingroup norms appeal condition ($M = 5.59$, $SD = 1.00$), compared to the control ($M = 4.96$, $SD = 1.32$), $t(122) = 3.00$, $p = .003$, $d = .54$. A second *t*-test examined the direct effect of the intervention on perceived ingroup norms. Water conservation ingroup norms were marginally significantly higher in the ingroup norms appeal condition ($M = 4.34$, $SD = 1.09$), relative to the control ($M = 3.99$, $SD = 1.09$), $t\ (122) = 1.810$, $p = .073$, $d = .33$.

A mediation analysis was then conducted to investigate whether the effect of the intervention on behavioural intentions could be explained by an increase in perceived water conservation ingroup norms. The analysis was conducted using bootstrapped tests of the indirect path (based on 5,000 bootstrapped resamples), with effects calculated using Hayes (2013) PROCESS macro (Model 4). Experimental

condition was entered as the independent variable (0 = control, 1 = intervention); ingroup water conservation norms as the mediator; and intentions to engage in water conservation behaviours as the dependent variable. The mediation model is depicted in Figure 6. In line with expectations, there was a significant indirect effect of condition on intentions through ingroup norms, b = .14, SE = .08, with a bias corrected confidence interval of .0025 to .3223. That is, the intervention led to perceptions that water conservation was ingroup normative, which in turn lead to higher intentions to engage in water conservation behaviours.

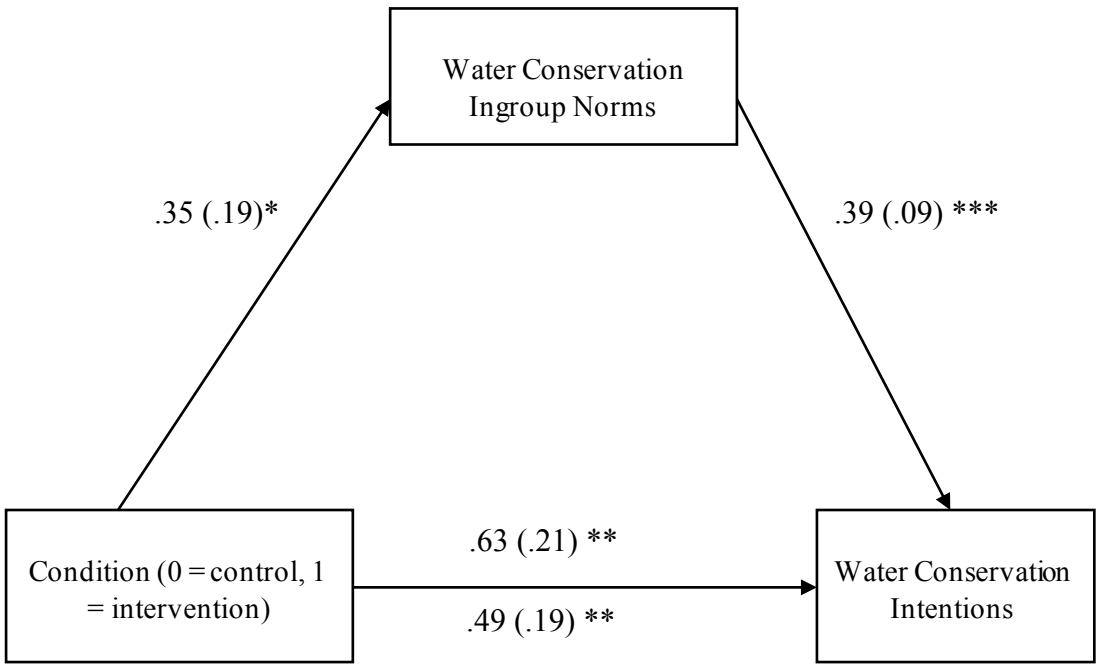

Figure 6 Mediational model of the relationship between the intervention condition and water conservation intentions through ingroup water conservation norms (Study 2)

Note: Path estimates represent unstandardized coefficients. Standard error is shown in parameters. The coefficient above the path from the path from the IV to the DV represents its effect without the mediator in the model (total effect), the coefficient below the path represents its effect when the mediator is included in the model (direct effect).

Note: Path estimates represent unstandardized coefficients. Standard errors presented in parentheses.

*$p < .10$ **$p < .05$ *** $p < .001$

as a covariate. As in *Study 1*, after adjustment for the rainfall-salience score, there was still a statistically significant difference in water behaviour intentions between the intervention conditions $F(1,121) = 8.84$, $p = .004$, $\eta^2 = .068$. The rainfall-salience score did not act as a statistically significant covariate ($p = .523$).

Two questions were asked to assess perceptions of a) water availability and b) stress: a) 'The East of England has abundant water resources' and b) 'The East of England can experience conditions of drought'. The questions were retained as separate items. There was moderate agreement that the East of England has abundant water resources (*M = 4.00, SD = 1.38)*. There was also agreement that the region can experience conditions of drought (*M = 5.02, SD = 1.46)*, suggesting that while respondents are cognisant of conditions of drought in the region, there may not exist an overall awareness of general water scarcity issues. These findings suggest that future water conservation interventions should supply information informing the audience that water availability is limited in the region. Promisingly, despite moderate agreement that the East of England has abundant water resources, the intervention was still successful in encouraging climate resilient water behaviour.

A second ANCOVA was conducted with baseline perceptions of water availability and stress included as a covariate. After adjustment for baseline perceptions of water availability and stress, there was still a statistically significant difference in water behaviour intentions between the intervention conditions $F(1,118) = 8.84$, $p = .004$, $\eta^2 = .07$. Baseline perceptions of water availability and

stress were not statistically significant covariates (*perceptions of drought*, $p = .281$; *perceptions of abundant freshwater,* reverse coded*,* $p = .106$).

3.3.5 Discussion

The results of *Study 2* provide further evidence of the efficacy of our social identity-based intervention approach and confirm the underlying mediational process. The observed trend suggests that individuals utilised the ingroup normative information provided in the intervention as a guide for their own behaviour, and subsequently intended to act in alignment with this newly acquired information. Importantly, *Study 2* also provided a replication in a new group context. By replicating the effect of the normative communication with a new referent group, results suggest that the intervention's effectiveness is not contingent on existing features of the group, but that if the group membership is meaningful, shifts in the ingroup stereotype should translate into concordant shifts in individuals' behavioural intentions.

3.3.6 Limitations

A potential limitation of Study 1 and 2 is the potential for demand bias to occur, whereby participants may guess the purpose of the study and as a result, alter their responses to conform with this suspicion. In the experimental conditions, a water conservation-related text was presented and participants were then asked to answer questions relating to the water conservation-specific behaviours and norms. As a result, responses may have been influenced by demand biases, thereby affecting the internal validity of the experiment. To overcome this potential limitation, future research could present the dependent variable couched in a series of other questions, so participants are less likely to determine the exact nature of the study.

3.4 Summary and Conclusion

Across two studies, we sought to examine the efficacy of the ingroup norms appeal and examine how this intervention compared to the prevailing communication campaigns utilised by industry (information-only approaches) or an existing baseline. The observed pattern suggests that integrating ingroup norms can increase the efficacy of such an intervention. The second study aimed to examine the key mechanism underlying an ingroup norms appeal: a change in perceived ingroup norms. It was found that in line with the referent informational influence process (Hogg & Turner, 1987; Oakes, Turner, & Haslam, 1991; Turner, 1982), when a climate resilient water behaviour social identity was made salient in an intervention, and supportive ingroup normative information was provided, individuals reported intent to behave consistently with this new information.'

Study 1 provided initial evidence for the efficacy of an ingroup norms appeal over-and-above an information-only or no-treatment control. While evidence of the effectiveness of an information-only intervention was observed, it was found that it was even more effective to frame this information in reference to behaviourally-relevant others. *Study 2* sought to extend our investigation by empirically testing the mediating role of ingroup norms. More explicit evidence was provided that the influence of an ingroup norms appeal on climate resilient water behaviour intentions is driven by changes in perceived ingroup norms. When group members learnt of the ingroup normative stance regarding climate resilient water behaviour, they internalised this norm and subsequently aligned their behavioural intentions in line with this new knowledge.

The ingroup norms appeal was efficacious across the two studies, with different samples and social identities. This replication provides confidence that the approach is not only effective, but it can be applied across different groups and in different contexts. It is noteworthy that effects were observed in groups who were not explicitly defined by established proenvironmental norms or concerns. While there is research examining the role of established environmental social identity on environmental behaviour (e.g. environmental activism; Dono, Webb, & Richardson, 2010), here, it was shown that the approach is influential in residential social groups that are not defined explicitly by their common environmental concerns or actions (e.g. climate change community group). Thus, it was demonstrated that climate resilient water behaviour norms can come to characterise a group that is not inherently linked to environmentalism or climate resilient water behaviour and increase group members' motivation to behave proenvironmentally.

Results persisted after controlling for both perceived rainfall on the day of the study and baseline perceptions of water stress and availability. In addition, it was found that while there was high awareness around prevalence of drought in the region, this did not extend to a high level of awareness around water stress in the region. This finding is important to consider, as the majority of climate resilient water behaviour studies are conducted in California or Australia, where awareness around water challenges is high. This finding suggests that it may be important to provide information about *why* saving water is important in a climate resilient water intervention in the UK in conjunction with an ingroup norms appeal.

Overall, these findings provide further support for the potential of social identity insights to be integrated into climate resilient water behaviour interventions in the residential domain. New empirical insights were provided into the role of

ingroup norms in the behaviour change process and examined the importance of communicating information around water scarcity, particularly given the misconceptions that surround water challenges in the UK.

4 Does Group Identification Moderate the Effect of an Ingroup Norms Appeal on Climate Resilient Water Behaviour?

In Chapter 3, it was demonstrated an ingroup norms appeal can successfully encourage climate resilient water behavioural intentions and this effect is mediated by changes in perceived ingroup norms surrounding water conservation. If this intervention is to be implemented at a wide-scale, it is crucial to ascertain 'who' the intervention best influences. The Social Identity Approach suggests that the effect of an ingroup norms appeal will be strongest when the salient social identity forms an integral part of one's self-concept and is a basis for self-definition, that is, if an individual highly identifies with the ingroup. This study offers the first examination of the possible moderating role of group identification in the context of a climate resilient water behaviour intervention. It was found that exposure to the ingroup norms appeal increased intentions to conserve water. This effect was qualified by a significant interaction with group identification, whereby effects were only significant for those possessing high or average levels of group identification. This knowledge can contribute to the initial evidence base around the moderating role of group identification in proenvironmental behaviour change interventions and be utilised to guide and inform practical applications of the approach in the future.

4.1 Introduction

In the previous two studies (*Chapter 3*), it was found that an ingroup norms appeal was successful in encouraging climate resilient water behavioural intentions

and that a perceived change in ingroup norms mediates the effect of the intervention on behavioural intentions. As such, in *Chapter 3*, we examined the 'why' (mediation): *Why is the ingroup norms appeal effective?* In *Chapter 4*, we seek to examine the 'who' (moderation): *Who will be most strongly influenced by an ingroup norms appeal?* This question is crucial, especially if this approach is to be utilised by industry and applied in large-scale behaviour change interventions. We must ascertain the variables that moderate the effect of an ingroup norms appeal on behaviour, so that they may be taken into account when considering how best to implement the intervention in a given context.

As outlined in *Chapter 2B*, the Social Identity Approach posits that a key variable moderating the effect of group-based phenomena on behaviour will be *group identification*. This is defined as the psychological attachment, or sense of belonging, a group member forms with their social group (Tajfel, 1981; Turner et al., 1987). Group identification can satisfy not only a need to belong, but can also foster a sense of pride, accomplishment, and self-esteem (Ellemers et al., 1997; Smith & Tyler, 1997). Group identification has been described as one of the most important variables in research on group relations as it moderates how individuals react to group-based phenomena. It can be conceptualised as varying on a spectrum of *no/weak* to *strong* identification (Hogg & Abrams, 1988; Neighbors et al., 2010). The Social Identity Approach posits that internalisation of ingroup preferences and norms will be strongest for people for whom the salient social identity forms an integral part of their self-concept, that is, for individuals who identify strongly with the group (Abrams & Hogg, 1990). As such, the strength of one's group identification will determine the extent to which referent informational influence

occurs when a social identity is salient (Kelly, 2011; Onorato & Turner, 2004). High, compared to low, levels of identification generally strengthen group-based effects.

4.1.1 Evidence of the Moderating Role of Group Identification

Research within the social identity tradition demonstrates that those who identify strongly with their group and perceive of themselves in reference to their group membership, will tend to act consistently with ingroup normative information when it is provided in an intervention. In two studies, Terry, Hogg and McKimmie (2000) found that the effect of referent informational influence on behaviour was more discernible for participants who possessed higher levels of identification to the group. In the first study, a social identity (psychology student) was made salient. Participants presented with supportive ingroup normative information relating to their chosen career choice were more likely to maintain their initial choice. In comparison, those presented with an unsupportive ingroup norm (in relation to their initial career choice) were more likely to re-evaluate and alter their initial choice. This effect was more marked for participants possessing higher levels of identification with the group. That is, when one possessed a high, compared to low, level of group identification, they were more influenced by ingroup normative information and aligned their behaviour accordingly. This pattern was replicated in the second experiment, whereby ingroup salience was manipulated in a jury (group) decision-making exercise. When exposed to ingroup normative information (attitudes towards five crimes) that ran counter to an individual's initial position, participants were more likely to alter their initial position to align with the ingroup normative information when the group was a salient basis for self-definition. In line with the first experiment, this effect was more discernible for participants who possessed higher levels of identification to the ingroup.

The role of group identification as a moderator variable has also been observed in TPB research examining social identity constructs (e.g. ingroup norms). For example, Terry and Hogg (1996) observed that ingroup norms significantly predicted participants' intentions to partake in regular exercise and to protect themselves from the sun, but this was only observed amongst participants (university students) who identified strongly with the referent group. For those possessing low levels of group identification, personal factors (e.g. perceived behavioural control in *Study 1*, and attitude in *Study 2*) were the strongest predictors of behavioural intentions.

Research conducted within the proenvironmental domain replicates this pattern of results. For example, Terry, Hogg, and White (1999) and Fornara and colleagues (2011) found that perceived ingroup norms predicted intention to recycle, but this was only observed amongst participants who identified with the salient social group. For those possessing low levels, personal considerations were stronger predictors of behavioural intentions. Similarly, group identification moderated the effect of ingroup norms on intentions to engage in sustainable agricultural practices in a study in Australia. For those possessing high identification with the ingroup (local agricultural community), ingroup norms predicted intentions, but this effect was not observed for those possessing low levels of group identification (Fielding et al., 2008).

Recent research further replicates this pattern of results. Masson and Fritsche (2014) found that individuals who highly identified with a given group adhered to climate-related ingroup norms more than group members who were less invested. In the first study, group identification was manipulated. In the high identification condition, participants were instructed to think about a group they both enjoyed belonging to and strongly identified with. In the low group identification condition,

participants were instructed to consider a group they belonged to, but only weakly identified with. Participants then completed measures of ingroup norms and climate-friendly behavioural intentions. It was found that for group members who highly identified with the group, perceptions of supportive climate-related ingroup norms increased behavioural intentions. This effect was not observed for low-identifiers.

In the second study, an ingroup norm was manipulated (supportive or unsupportive of purchasing organic food). Participants were presented with fabricated ingroup normative information. In the supportive norm condition, participants read that the majority of their ingroup (students at the university) preferred to purchase organic food as opposed to non-organic and expected their fellow students to do so (supportive descriptive and injunctive norm). In the unsupportive condition, participants read only a minority purchased organic food and fellow students were not expected to purchase organic produce (unsupportive descriptive and injunctive norm). As expected, group members expressed higher intentions to purchase organic food when a supportive norm was presented and notably, this effect only occurred for those who highly identified with the group.

Additional complementary evidence from within the residential water domain also suggests group identification can moderate environmental message uptake if the message is delivered by an ingroup member, as we tend to judge ingroup members as more affable and trustworthy in comparison to outgroup members (Hogg & Reid, 2006; Tanis & Postmes, 2005). Schultz and Fielding (2014) demonstrated that a communication aiming to increase support for recycled water was enhanced when the information was delivered by an ingroup member (a scientist sharing the same identity), as opposed to a scientist whose identity was not disclosed. Importantly, this effect was only observed for those who identified strongly with the group.

4.2 Current Research

Study 3 extends the research by examining the role of group identification as a potential variable moderating the effect of an ingroup norms appeal on water conservation behaviour. As such, we gain insight into the question of 'who': *For whom is this intervention influential?* This question was examined on a student university sample in Norwich, in the East of England; a region that experiences water stress. This study sought to establish whether the effect of an ingroup norms appeal on water conservation intentions is moderated by group identification: does *higher* identification with the ingroup lead to *greater* intention to engage in climate resilient water behaviour following exposure to the intervention? This moderation effect was tested in *Study 3* using water conservation intentions as the outcome variable. We would expect the intervention to be more behaviourally relevant for high identifiers versus low identifiers. Specifically, it is hypothesised that:

H1: The ingroup norms appeal will increase intentions to conserve water; and

H2: This effect will be more pronounced at high versus low levels of group identification

4.2.1 Participants, Design, and Materials

A total of 101 students were recruited over one day in the central square at the same university sampled in *Study 1.* The sample consisted of 63 females, 36 males, and two participants who did not disclose their gender, aged between 18 and 34 (M = 20.92, SD = 2.94). Participation was limited to people who had not taken part in any of the previous studies within this investigation. No exclusions were made. Participants were randomly assigned to either the intervention condition (n = 49), or

the control condition (n = 52) in a between subjects design. If participants were approached in groups, they were allocated to the same condition, and were asked not to discuss their answers until the questionnaire was returned. The ingroup was students at the university, as per *Study 1*.

4.2.2 Procedure

To commence the study, participants completed a seven-item group identification measure (adapted from Hinkle, Taylor, Fox-Cardamone, & Crook, 1989). Items were measured on a seven-point scale and presented with item-specific anchors: 'To what extent do you feel strong ties with UEA students?' (from 1 = *No ties at all* to 7 = *Extremely strong ties);* 'How similar do you think you are to the average UEA student?' (from 1 = *Not at all similar* to 7 = *Extremely similar).* Items were combined into a composite index of group identification (α = .84).

Participants were then exposed to the intervention or control condition. Participants in the experimental condition were then presented with the ingroup norms appeal. The experimental message was adapted from *Study 2* and included one refinement: the connection between water conservation and the ingroup identity was explicitly stated: '*Saving water and caring for the environment is part of who we are*' (*see* Figure 7). The no-treatment control served as a baseline. Participants in the control condition did not read any additional text.

UEA students save water

At UEA we know that fresh water is a limited resource, and it's important to us to save every drop.

As UEA students, we're trying our best to save water wherever we can.

We're proud to be water savers and we do our bit to save water - we wait until we have a full load before washing our clothes; we turn off the tap when we brush our teeth; and we turn off taps if we see them dripping.

Saving water and caring for the environment is part of who we are.

Figure 7 Ingroup norms appeal intervention text

We then measured water conservation intentions across both conditions with an extended eight-item measure, adapted from *Study 1* and *2*. The three behaviours that were explicitly mentioned in the experimental message (informed by the pilot test) were included in the measure to form an extended behavioural intentions measure. These items included: 'Wait until there is a full load of washing before beginning a wash cycle'; 'Turn off the tap when brushing teeth'; and 'Turn off the tap if it is dripping'. Respondents indicated how likely it was that they would perform each behaviour over the next few months (from 1 = not *at all likely* to 7 =

very likely, α = .77). To conclude the experiment, participants provided demographic information, completed the three-item perceptions of water stress scale, and were thanked and debriefed (*see* Appendix C for complete survey).

4.2.3 Results and Discussion

An independent samples *t*-test on ingroup identification scores (7-point Likert scale) revealed that there was no significant pre-intervention difference between the experimental condition (M = 5.10, SD = .82) and control condition (M = 5.08, SD = 1.08), *Mdiff* = .02, *SE* = *.19* ($t(98) = -.119$, $p = .906$). As the mean is above the midpoint for both groups, it confirms the social identity selected is relevant and meaningful to the respondents.

As anticipated, after reading the experimental text, water conservation intention scores (eight-item measure) were significantly higher in the experimental condition (M = 5.07 , SD =1.09) compared to the no-treatment control (M = 4.58 , SD =1.00), *Mdiff* = .49, *SE* = .21 *(*$t(99) = -2.37$, $p = .020$, $d = .47$) (*see* Figure 8). This pattern was also observed for the five-item measure of water conservation intentions (not including the three behaviours explicitly mentioned in the ingroup norms appeal). This second measure of intentions was included to account for any potential demand effects from explicitly stating these behaviours. When the three items were removed, the effect persisted. Scores were significantly higher in the experimental condition (M = 4.14 , SD = 1.49) compared with the control (M = 3.56*,* SD = 1.12), *Mdiff* = .57, *SE* = .26 *(*$t(99) = -2.18$, $p = .032$, $d = .44$). As the pattern did not change, the longer eight-item measure was retained for the subsequent moderation analysis.

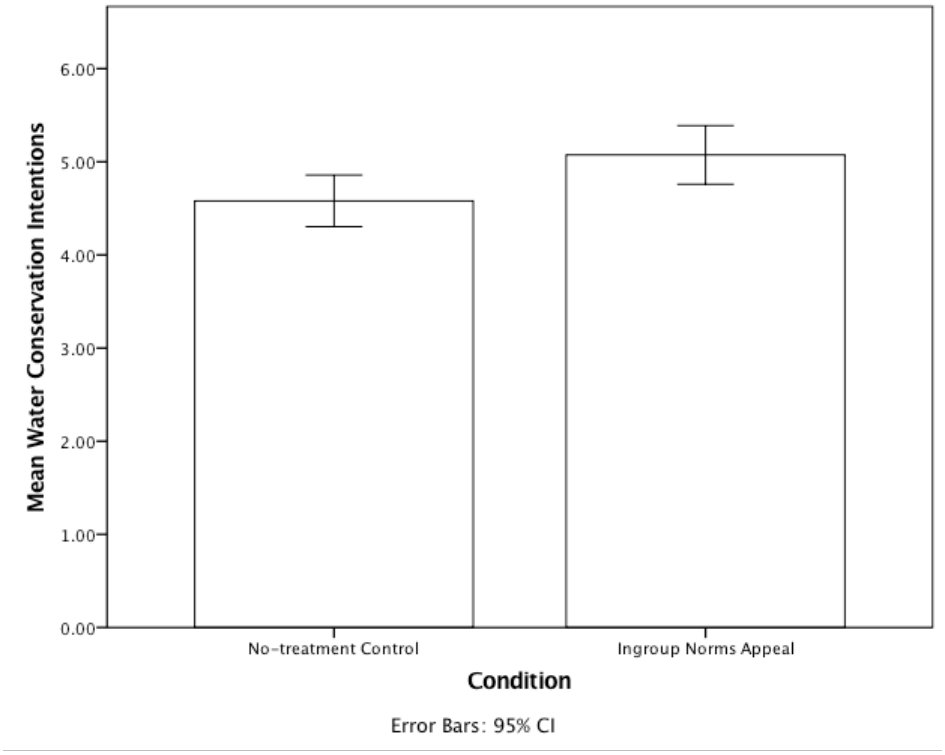

Figure 8 Mean water conservation intention scores across the two conditions: *No-treatment Control* and *Ingroup Norms Appeal*

A moderation analysis was then conducted to examine whether the effect of the intervention was moderated by group identification. Hayes' (2013) PROCESS macro for SPSS (Model 1) was used to conduct the analysis, based on bootstrapping with 5,000 resamples. A significant interaction between condition and group identification was observed, $\beta = .60$, $p = .007$. Simple slopes analyses examined the effect of condition on climate resilient water behavioural intentions when group identification was high (+ 1 *SD),* equal to the mean (0 *SD),* and low (- 1 *SD*). In line with predictions, the effect of the intervention (vs. control) on water behavioural intentions was significant when group identification was high ($\beta = 1.04$, $p < .001$), significant, but to a lesser extent, when group identification was equal to the mean (β

= .46, p = .025), and was reduced and nonsignificant when group identification was low (β = -.12, p =.679) (*see* Figure 9). As expected, the manipulation had a positive and significant effect on water conservation intentions for those that identified highly with the ingroup identity. This effect was more pronounced for participants who possessed a higher level of group identification in comparison to those with an average level of group identification. For those with low levels of group identification, the effect of the ingroup norms appeal was negative and non-significant.

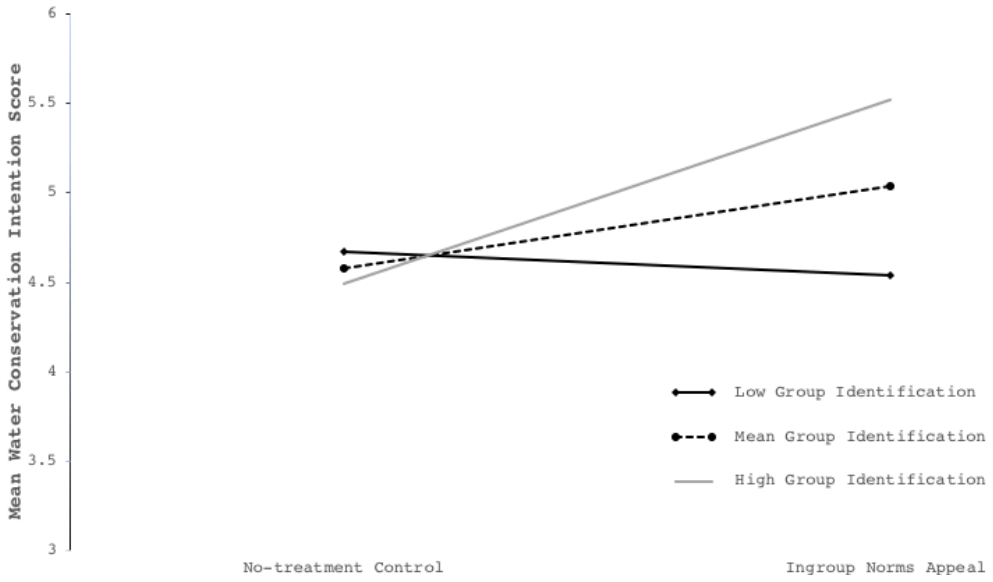

Figure 9 Mean water behavioural intention score as a function of experimental condition and group identification

4.2.3.1 Supplementary Analysis

A sum score of the three rainfall-salience questions was calculated, consistent with *Study 1* and *2*. An ANCOVA was conducted with the rainfall-salience score entered as a covariate. As in *Study 1* and *2*, after adjustment for the rainfall-salience

score, there was still a statistically significant difference in water conservation intentions between the ingroup norms appeal condition and the control $F(1,98) = 5.49$, $p = .021$, $\eta^2 = .001$. The rainfall-salience score did not act as a statistically significant covariate ($p = .804$). In addition to the ANCOVA, the rainfall-salience score was entered as a covariate in the moderation analysis (PROCESS macro for SPSS (Model 1)). The interaction effects persisted after controlling for this factor.

4.3 Summary and Conclusion

Study 3 examined the role of group identification as a moderating variable in an ingroup norms appeal intervention. Given the potential for the ingroup norms appeal to be applied by industry, it was crucial to ask the question: *Who will be most strongly influenced by an ingroup norms appeal?* This is the first study to examine how group identification moderates the influence of an ingroup norms appeal in the context of residential water behaviour. It was found that exposure to the ingroup norms appeal increased intentions to conserve water. This effect was qualified by a significant interaction with group identification, whereby effects were only significant for those possessing high or average levels of group identification. The effect of the ingroup norms appeal on intentions was non-significant for those with a low level of group identification. For these participants, the effect of the intervention was nonsignificant.

These findings align with insights from the social identity literature. As reviewed in *Chapter 2B*, Social Identity Theory suggests that group identification should play a key role as a moderating variable. Individuals who identify with the group will be more likely to align their behaviour to the group norms than those possessing lower levels of group identification (e.g. Terry & Hogg, 1996; Fielding et

al., 2008). The strength of one's group identification should moderate the effect of social identity on perception and behaviour (Kelly, 2011; Livingstone, Haslam, Postmes, & Jetten, 2011).

In the context of our ingroup norms appeal, we would expect those with higher levels of identification to the student group to adhere more strongly to the ingroup norms communicated in the appeal. Additionally, we would expect those who do not identify with the group, or possess weaker levels of identification, to be less (or not at all) influenced by the intervention. If one does not identify with a social group, the norms of that group should not hold sway over their behaviour. Prior research suggests that those possessing weaker levels of group identification will likely to instead be influenced by other considerations, such as personal attitudes (e.g. Terry & Hogg, 1996; Terry et al., 2000).

Importantly, our findings show that group identification is a crucial variable to consider when applying an ingroup norms appeal. These findings are important for practitioners to consider. They provide valuable practical insights into the application of the approach, namely, it is unlikely to be effective in contexts where individuals only possess a weak level of identification with the salient social group in an ingroup norms appeal. This may occur for a variety of reasons. For example, if an ingroup norms appeal makes a local community identity salient, but it is not an established community (e.g. a military base with a transient population or residents have not lived there long enough), that identity may not have had the time to develop, and consequently, residents may not be influenced by an ingroup norms appeal. Additionally, intervention designers may inavertedly draw on an identity that individuals do not identify or are unfamiliar with, for example, making a regional social identity salient when that region is not commonly used to describe or

categorise a social group, or alternatively, draw on a social identity that the targeted population is reluctant to identify with (e.g. a neighbourhood identity, when the neighbourhood has negative connotations associated with it). It is important to select an identity that resonates with the targeted population.

As such, it is crucial that intervention designers conduct comprehensive pre-testing of the approach, to determine the most appropriate social identity to draw on in an ingroup norms appeal. One way to do this would be to administer a pilot study with a representative sample, whereby respondents rank different social identities - that have been recognised as being potentially meaningful to the sample population – on a measure of group identification (e.g. Hinkle et al., 1989). This would provide practitioners with insight into the most appropriate identity to select.

In contexts where group identification is low, there are two alternative possibilities: a) select an alternative social identity that resonates with the targeted population; or b) adopt a general social norms approach that highlights what the majority of 'others' do, without specifying *who* those others are. This approach may offer a promising alternative to influence behaviour (e.g. '80 percent of people surveyed turn off the tap whilst brushing their teeth') (Cialdini & Goldstein, 2004; Cialdini et al., 1990).

As with *Study 1* and *2*, a potential limitation of *Study 3* is the potential for demand effects to bias the responses of those in the experimental condition, thereby posing an adverse risk to the internal validity. Future research should aim to mitigate this risk through the utilisation of methodological techniques such as couching the dependent variable in with other questions or tasks, so attention is diverted away from the true dependent variable and purpose of the study.

Overall, *Study 3* demonstrated that an ingroup norms appeal influences water conservation intentions and this effect is moderated by group identification. The intervention was influential for average and high identifiers, but it did not influence those possessing a low level of identification with the group. These findings can be utilised to inform and guide future applications of the approach. Importantly, they highlight the importance of pre-testing to ensure the selection of a social identity that resonates with the targeted population. The findings from this study contribute to the initial evidence base around group identification as a moderator variable in proenvironmental behaviour change interventions, and also offers valuable insights for those considering applying an ingroup norms appeal in the context of residential water behaviour.

5 Is an Ingroup Norms Appeal More Effective Than a General Social Norms Appeal for Encouraging Climate Resilient Water Behaviour?

Three studies have now provided evidence of the power of ingroup norms to influence the climate resilient water behaviour of group members. The strongest test of our ingroup norms appeal, however, is to compare it to a standard social norms appeal. Drawing on a social identity perspective, we expect norm adherence to be strongest when norms are tied to a specific referent group that is salient in the behavioural context. Study 4 directly tests this hypothesis by providing the first empirical test of the efficacy of an ingroup norms appeal against a general social norms appeal on behaviour. In a randomised control trial conducted at a university halls of residence, the comparative effects of the two normative interventions on a targeted water behaviour (a reduction in shower time) was observed. We find that although a general social norms appeal is effective in encouraging climate resilient water behaviour, the effect is strengthened when the appeal is framed in reference to 'ingroup others'. In addition, supplementary exploratory analyses suggest both normative interventions led to positive behavioural spillover, whereby participants extended their efforts to save water outside of the bathroom, thus, potentially extending the net effect of the normative interventions.

5.1 Introduction

As *Chapter 2A* outlines, initial evidence suggests that normative influence can be harnessed to encourage climate resilient water behaviour and can contribute to demand management strategies in water scarce regions. From both a theoretical and

practical perspective, it therefore becomes important to understand whether there are ways to enhance the influence of the approach. The Social Identity Approach suggests that social norms messaging - communicating what others are doing - will be maximally effective if framed in reference to *relevant others*, rather than *general others* (Terry & Hogg, 1996; Terry, Hogg, & White, 1999). That is, a social norms appeal will be *even more* influential when it is tied closely to salient group memberships and climate resilient water behaviour ingroup norms are communicated. This occurs as a result of the *depersonalisation* process. When a social identity is salient, we come to redefine ourselves in terms of our group membership (Turner, Hogg, Oakes, Reicher, & Wetherell, 1987). We perceive ourselves in terms of the defining attributes of the ingroup, and our perceptions, emotions, attitudes, and behaviour assimilate to that of the group (Hogg & Turner, 1987; Turner, 1985). Considering this process, it is then not the norms of *general others* that influence behaviour, but the norms of *ingroup others*.

Evidence of this process is observable if we re-examine existing social norms research in the proenvironmental behaviour domain through a social identity lens. In an investigation of household energy consumption in California, Nolan and colleagues (2008; as cited in Griskevicius, Cialdini, & Goldstein, 2008) found that the influence of perceived social norms grew stronger the closer and more similar the referent group was to the individual. The decision to conserve energy was most powerfully influenced by the norms of other residents in one's specific community, followed by other people in their city, followed by other Californians generally. In addition, Datta and colleagues (2015) found in their assessment of a social norms appeal in a water conservation intervention in Costa Rica that the appeal was successful in encouraging climate resilient water behaviour, but *only* when it was

framed in reference to fellow neighbourhood members, not when it was framed in reference to city residents. The social identity perspective suggests the effectiveness of the appeal relates to the perception that 'others' who live in one's local community represent fellow ingroup members. While these studies did not set out to integrate the referent informational influence process into their design, in framing the information in reference to a behaviourally relevant group, the experiments may have inadvertently activated the power of group influence. As such, a re-examination of these findings suggests that social norm appeals may be enhanced by framing the appeal in reference to an *ingroup*, as opposed to *general others*.

As discussed in *Chapter 2B*, research into the TPB has provided complementary evidence to support this notion. Research from the proenvironmental domain has shown that integrating social identity concepts into the model can increase the models' predictive validity. Importantly, one of the most consistent findings in this area has been that *ingroup norms* predict behavioural intentions beyond the standard TPB variable *subjective norms*; defined as approval of important others (Ajzen, 1985, 1991). For example, Terry, Hogg, and White (1999) and Fornara and colleagues (2011) found that perceived ingroup norms predicted intentions to recycle beyond perceived subjective norms. Similarly, in a sample of farmers in Australia, Fielding and colleagues (2008) found ingroup norms influence intentions to engage in sustainable agricultural practices. These findings demonstrate that consistent with the social identity perspective, ingroup norms may be a more accurate predictor of behaviour than the norms of general others.

5.1.1 Comparison to a General Social Norms Appeal

Within the residential water domain, one previous study has compared a social identity intervention against a general social norms appeal. Seyranian, Sinatra

and Polikoff (2015) utilised a social identity framing communication strategy, in which households in California were provided with a short communication linking general proenvironmental behaviours to a local city identity using high levels of inclusive language to convey that acting proenvironmentally is 'who we are' as a city (p. 85). This was compared against a general social norms approach, whereby residents received personal water consumption feedback, in conjunction with feedback on average water usage feedback within their immediate neighbourhood (descriptive norm) and a positive emoticon (☺) if they were below the mean or a negative emoticon if they were consuming more water than the neighbourhood mean (☹) (injunctive norm). Seyranian and colleagues did not find evidence of higher levels of behaviour change following a social identity-based intervention compared to a social norms-based intervention (both were effective compared to baselines). However, the study was not designed to conduct a strict comparative test of an ingroup norms appeal against a general social norms appeal. The actual content of the interventions was different across these two conditions, limiting the ability to make meaningful comparisons. While the social identity intervention targeted a particular group identity and involved a short communication constructed with group level rhetoric, the social norms intervention involved personalised water usage feedback, which was augmented with information about whether their usage was above or below the neighbourhood mean. Moreover, this social norms intervention may have inadvertently tapped into the influence potential of group-level norms by referring to the 'average home in your neighbourhood' (Seyranian et al., 2015, p. 85).

Additionally, in the social identity communication developed by Seyranian and colleagues (2015), normative information was provided in reference to the city

government, rather than the group members per se. This study aimed to test an ingroup norms appeal that specifically referenced and provided normative information about the target ingroup, in order to optimise the influence of the referent informational influence process. Therefore, this study sought to provide a more controlled examination of normative communications that focus on general social norms, compared to those that are informed by the Social Identity Approach and focus specifically on ingroup norms.

We aimed to conduct a comparative test of the two normative interventions. The first, a general social norms appeal, would provide normative information framed in reference to general 'people'. It would not include consumption feedback or make any reference to a specific social group (e.g. your neighbourhood). In our ingroup norms appeal, the normative information would be identical, but would be framed in reference to the salient social group (in this case, university students). The interventions were tested in a field experiment within a university halls of residence. Thus, the current study moved beyond our initial measure of behavioural intentions (*Studies 1-3*) to a measure of self-reported behaviour.

5.1.2 Measure of Behaviour

It is important to move beyond measures of behavioural intentions, as stating an intention to undertake a behaviour does not immediately translate to one *actually* undertaking the behaviour (*intention-behaviour gap*; Sheeran (2002)). Sheeran (2002) completed a meta-analysis of meta-analyses to examine how well intentions predict behaviour and found that intentions explain 28 percent of the variance, on average, in behaviour. Thus, there are additional variables, or barriers, that can determine whether one undertakes a behaviour after stating an intention to do so, and these may operate at both an individual and societal-level (e.g. Lorenzoni,

Nicholson-Cole, & Whitmarsh, 2007). Thus, while a measure of behavioural intentions offers valuable insight into the effects of an intervention, this can be enhanced with measures of self-reported past behaviour or an objective measure of behaviour.

5.1.3 Targeting a Specific Behaviour

In addition, while the first three studies focused on a broad measure of climate resilient water behavioural intentions and Seyranian and colleagues (2015) sought to incentivise general water saving behaviour, this study examined whether the ingroup norms appeal would influence a specific behaviour: a reduction in time in the shower. It is recommended that interventions should be designed to target high-impact behaviours (Steg & Vlek, 2009), and showering accounts for the largest proportion of total household water consumption in the UK (Energy Saving Trust, 2013). At the university where this research was conducted, student accommodation accounts for 64 percent of the total water consumed on campus (UEA, 2016). The university is located in the East of England; one of the most water scarce regions in the UK (Committee on Climate Change, 2016). Any reduction in water used in the shower would therefore have clear benefits. The current study therefore aimed to understand whether the interventions could influence a targeted high impact behaviour.

5.1.4 Behavioural Spillover

As a secondary aim, the current study also sought to extend the research and conduct an exploratory analysis to examine whether a normative appeal could lead to behavioural spillover. As *Study 4* tested the effect of the normative appeals on a targeted behaviour, rather than general water saving intentions, it was then possible

to examine spillover effects. Recent advancements in proenvironmental behavioural research have investigated the potential for behaviours that are not directly targeted to also shift as a result of a behavioural intervention (Nash et al., 2017; Truelove, Carrico, Weber, Raimi, & Vandenbergh, 2014). Behavioural spillover is defined as an observable and causal effect one behaviour has on another. This may either be positive, whereby an increase in one behaviour leads to an increase in another, or negative, whereby an increase in one behaviour leads to a subsequent worsening of another. To constitute spillover, the behaviours must be: a) different; b) one behaviour must follow another; sharing a common motive, such as water conservation; and c) involve a common link, such as reducing water consumption (Nash et al., 2017, p. 2).

Determining whether spillover occurs in an intervention is important, as it is vital to have an understanding of the true net effect of a given intervention, rather than just an understanding of whether the targeted behaviour changed (Gillingham, Kotchen, Rapson, & Wagner, 2013). However, despite its importance, much of the work conducted in this area has been correlational in nature or conducted in small one-off laboratory studies (Lanzini & Thøgersen, 2014; Truelove et al., 2014). In addition, the initial body of evidence around proenvironmental behavioural spillover is inconsistent and is highly contextually dependent (Nash et al., 2017). Despite these limitations, recent research suggests that positive spillover may occur in the context of climate resilient water behaviour.

Lauren and colleagues (2016) measured behavioural spillover effects across two time points and found that increases in simple water conservation behaviours (e.g. have shorter showers; be water-wise in the garden) as a result of a four-month intervention, led to an increase in self-efficacy, which then strengthened behavioural

intentions to carry out more difficult behaviours (installation of water efficiency devices) and subsequently, nine months later, led to a higher uptake of water efficiency devices being installed. In addition, analysis of Watersmart's social norms intervention in California, detailed in Section 2.1.3, found that households exposed to the water savings reports were 2.3 times more likely to participate in subsequent audit and rebate programmes, thereby extending the overall effect of the intervention (Mitchell & Chesnutt, 2013). As such, although empirical evidence in the water domain is limited, there may be potential for positive behavioural spillover to occur.

In the current study, we may anticipate water behaviour to change in domains explicitly targeted in the intervention. This may be attributed to a desire for behavioural consistency; as participants begin reducing water consumption in the shower, they may be motivated to behave consistently in other areas, in a bid to increase cognitive consistency. Cognitive dissonance (Festinger, 1962) is a theory central to the concept of positive behavioural spillover (Nash et al., 2017; Thøgersen, 2004). Festinger (1962) posits that when one engages in inconsistent behaviour (e.g. saving water in the shower, but wasting water in the kitchen), they will experience an unpleasant feeling, known as cognitive dissonance. In order to avoid this, there will be a tendency to ensure their behaviours are consistent. In the context of a climate resilient water behavioural intervention, we would expect that if our normative appeals are successful in encouraging water conservation in the shower, individuals may then feel it is inconsistent to waste water in other areas, and therefore, may alter their water-use behaviour outside of the shower to achieve a sense of behavioural consistency, thereby reducing cognitive dissonance.

Given that the initial evidence base of behavioural spillover in the climate resilient behaviour domain is limited (Nash et al., 2017; Truelove et al., 2014) and

given the importance of understanding the true net effect of a behavioural intervention, this study sought to understand whether a general social norms or ingroup norms appeal targeting a specific, high-impact behaviour would lead to positive behavioural spillover to additional domains within and outside the home.

5.1.5 Group Identification as a Potential Moderator

In addition, the current study sought to extend the examination conducted in the previous chapter and assess whether group identification moderated the effect of the normative appeals on the targeted behaviour. We would not anticipate group identification to moderate the effect of the general social norms appeal. A specific group identity was not made salient in the general social norms appeal, and as such, the referent informational influence – moderated by group identification – would not subsequently be activated. In comparison, in the ingroup norms appeal condition, we would anticipate group identification to moderate the effect. In line with the results from *Study 3*, it was expected group identification would significantly moderate the effect on behaviour for those possessing high or average levels of group identification, but not for those participants possessing a low level of group identification.

5.2 Current research

The aim of *Study 4* was two-fold: 1) to test our intervention in the field, focusing on a targeted behaviour (reducing time in the shower by one or two minutes); and 2) to provide a true comparative test of a general social norms appeal against an ingroup norms appeal in the context of climate resilient water behaviour. The supplementary exploratory analysis sought to understand whether the interventions could encourage positive spillover to non-bathroom water behaviours,

and whether group identification moderated the effect of the ingroup norms appeal on behaviour, consistent with findings in *Study 3*.

While previous studies (e.g. Seyranian et al. (2015)) aimed to encourage a change in general climate resilient water behaviours in the home, in this current study, we specifically targeted a high impact behaviour. The current study therefore aimed to understand whether normative interventions targeting a high-impact water behaviour would lead to a change in behaviours not explicitly targeted in the intervention. In *Study 4*, it was hypothesised that:

> **H1:** In comparison to a baseline (no-treatment control), a normative appeal will be more effective when framed in reference to a specific, behaviourally-relevant referent group (*ingroup norms appeal*), rather than when framed in reference to a general non-specified social group (*general social norms appeal*); and
>
> **H2:** There will be potential for positive spillover to occur (in both normative conditions) as participants are motivated to act consistently in domains not specifically targeted in the intervention

5.2.1 Participants, Design, and Materials

Data was collected from first-year undergraduate participants living in the halls of residence at the same university as used in *Study 1* and *3* (UEA). A total of 1019 single occupancy en-suite rooms were available across three residential blocks. Each room was randomly assigned to one of the three conditions in a between-subjects design: ingroup norms appeal; general social norms appeal; or control (no intervention) condition. Rather than manipulating the independent variable at the level of residential block and risk any block-related confounds (e.g. blocks being

different in style or condition), each of the three residential blocks were divided into subgroups and each subgroup was allocated to one of the three conditions (e.g. Group A across all three residential blocks was allocated to the ingroup norms appeal condition; Group B to the general social norms appeal condition; and so forth).

Of the 1019 rooms included in the trial, a total of 512 questionnaire responses were received from their occupants (50.24 percent return rate). The final sample consisted of 303 females; 198 males; one transgender participant; and 10 who did not report their gender. All respondents were in their first-year at university, as reflected by a rather narrow age distribution (M = 19.06, SD = 1.31). Responses were relatively equally distributed across the ingroup norms appeal (n = 193); general social norms appeal (n = 167); and the no-treatment control condition (n = 152).

5.2.2 Procedure

Intervention materials were installed while students were away from the university for Easter break. During this time, members of the university cleaning team went into rooms and placed waterproof stickers bearing the intervention messages in students' en-suite shower cubicles. The intervention text can be seen in Figure 10. The behaviour targeted by the intervention was a reduction in shower time by one or two minutes. Showering is the highest impact water behaviour in the university accommodation (UEA, 2016), and this behaviour is consistent with general water saving advice offered by the water utility company in the East of England (Anglian Water, 2015b). In the university accommodation, this reduction in time would translate to 7-14 litres of water per shower. The general social norms appeal sought to encourage this behaviour by suggesting it represents a common

water saving strategy used by other people generally. In the ingroup norms appeal, the normative information was the same, but this time a group context and source was provided. Saving water by reducing time in the shower by one or two minutes was presented as something that was normative amongst other students at the university. An illustration of a university mascot also accompanied the text to increase the salience of the social identity. No sticker was placed in the rooms assigned to the control condition. The intervention period began when students returned to the residences for the spring semester. Two weeks later, members of the university cleaning team left a survey in every room, along with a bag of sweets to incentivise participation.

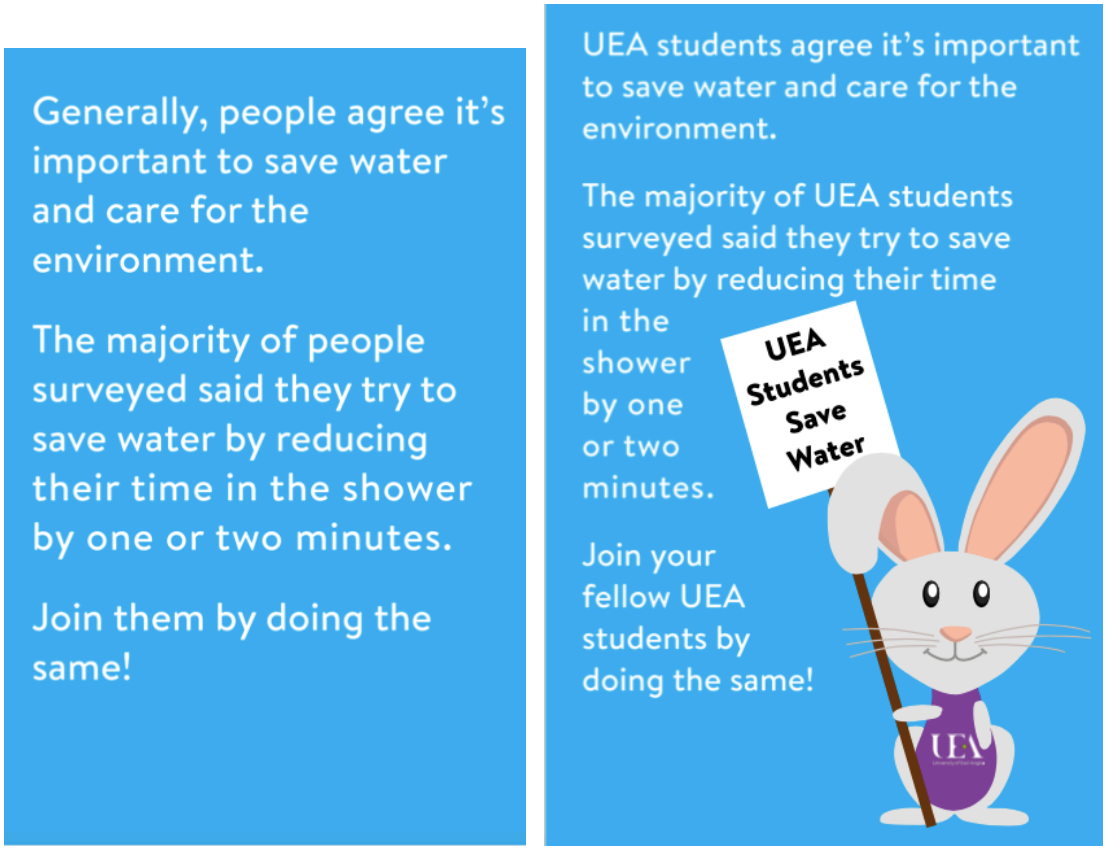

Figure 10 Waterproof stickers used in the *general social norms appeal* condition (left) and the *ingroup norms appeal* (right) in *Study 4*

5.2.2.1 Survey

Condition Assignment Confirmation. To commence the survey, participants answered which building and block they resided in.

Self-reported Shower Time. Participants completed the principal dependent variable: participants' self-reported shower duration. Participants were then asked to estimate how long they spent in the shower, on average, over the last two weeks (post-intervention shower duration), as well as how long they generally spent in the shower, not including the last two weeks (pre-intervention shower duration).

Behavioural Spillover. A four-item behavioural spillover measure was then presented: 'Again, thinking about the last two weeks, to what extent did you try and reduce your water consumption: In the bathroom? In the kitchen? When doing laundry? Outside of your accommodation?' (from 1 = *Not at all* to 7 = *Every time).*

Group Identification. Participants then completed a three-item measure of ingroup identification consisting of items including: 'I am proud to be a UEA student'(from 1 = *Strongly disagree* to 7 = *Strongly agree).* Items were combined into a composite index of group identification ($\alpha = .93$).

Manipulation check. By way of a manipulation check, participants' awareness of the stickers that had been placed in their bathroom was measured, 'Did you notice a new sign or sticker in your bathroom over the last two weeks?' (0 = *no*, 1 = *yes*).

Sociodemographics and Completion. Sociodemographic questions were then presented. Completed surveys were collected by the cleaning team on their return visits (*see* Appendix D for survey).

5.3 Results and Discussion

5.3.1 Manipulation Checks

Awareness of the intervention stickers was high across both the social norms intervention condition (94 percent), and social identity intervention condition (95.7 percent) suggesting participants attended to the intervention material.

5.3.2 Self-reported Shower Time

A univariate ANOVA was first conducted to confirm that there were no difference between conditions on pre-intervention self-reported shower duration, $F(2, 512) = .909$, $p = .403$. There were no pre-intervention differences on showering time.

To test for intervention effects, a difference score was then calculated by subtracting post-intervention average showering time (minutes) from pre-intervention average shower time (minutes). The difference score corresponded to the reduction in shower time over the intervention period and served as the principal outcome variable. Examination of the distribution of difference scores revealed twenty-seven outliers, which were Winsorized to 2 SDs above the mean (for similar procedure see Schultz et al., 2016).

Across the full sample the average reduction in shower time was 0.87 minutes, from a pre-intervention average time of 11.68 minutes (*see* Table 2).

Table 2 *Means, Standard Deviations, and Mean Difference of Pre-Intervention and Post-Intervention Average Shower Time (Minutes) Per Condition*

	Pre-intervention		Post-intervention		Mean Difference
	M	*SD*	*M*	*SD*	M_{Diff}
No-treatment Control	12.06	7.45	11.34	6.78	0.63
General Social Norms	11.95	7.29	11.19	7.17	0.76
Ingroup Norms	11.14	6.27	9.82	5.49	1.32

Note: Values reported here are not Winsorized

A univariate ANOVA tested for difference in mean reduction in shower time between conditions. The assumption of homogeneity of variance was violated, therefore Welch's F-ratio is reported. There was a significant effect of condition on mean reduction in shower time, Welch's $F(2, 335.67) = 4.54$, $p = .010$, $\eta^2 = .018$. As anticipated, reductions in shower time increased in a step-wise trend, from the control, to the general social norms appeal condition, to the ingroup norms appeal condition (*see* Figure 11). Games-Howell pairwise comparisons revealed a significant difference in reduction in shower time (minutes) between the ingroup norms appeal condition ($M = 1.22$, $SD = 2.10$) and the control ($M = 0.54$, $SD = 1.83$) (*Mdiff* =0.68, 95% CI [0.18, 1.17], $p = .004$). Reduction in shower time was marginally significantly higher in the ingroup norms appeal condition compared to the general social norms appeal condition ($M = .75$, $SD = 2.17$) (*Mdiff* = 0.47, 95% CI [-0.06, 1.00], $p = .095$). There was no significant difference between the general social norms appeal and control condition (*Mdiff* = 0.20, 95% CI [-0.32, 0.73], $p = .63$).

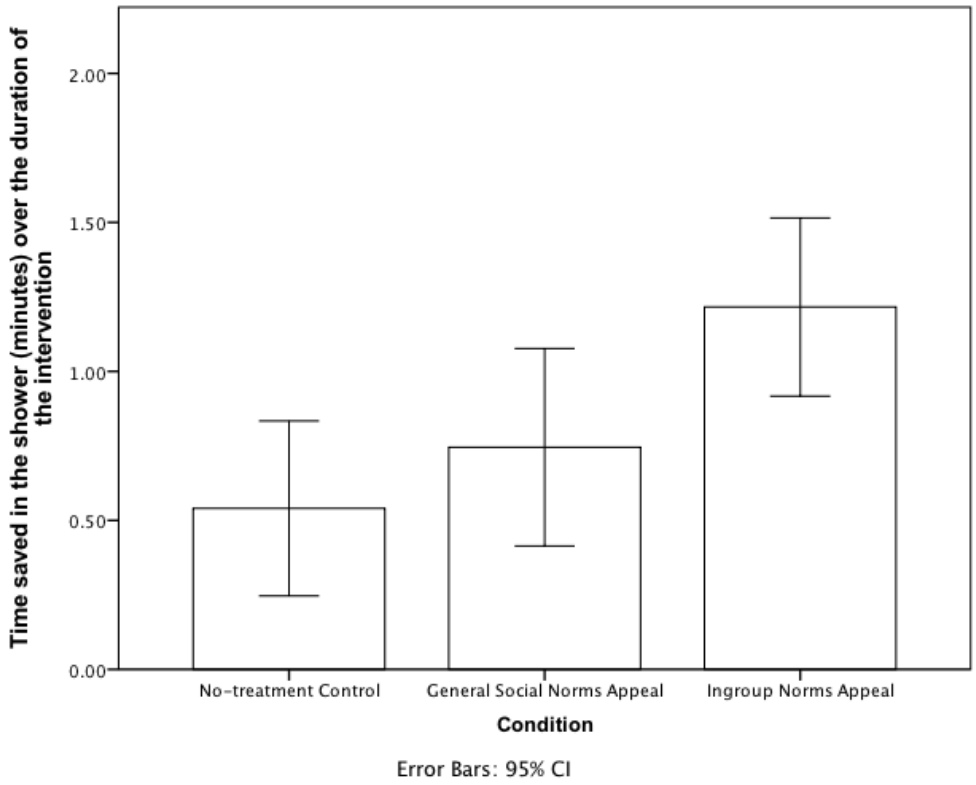

Figure 11 Mean reduction in shower time by Condition in Study 4

5.3.3 Behavioural Spillover

Finally, broader water behaviours in the different behavioural domains were analysed: in the bathroom, kitchen, laundry, and outside of the accommodation.

Bathroom. As our targeted behaviour (showering) occurred in the bathroom, it was considered to be the domain that was specifically targeted in the intervention. A univariate ANOVA revealed that there was a significant difference in the extent to which respondents tried to reduce their water consumption in the bathroom $F(2,500) = 6.058$, $p = .003$). Tukey post hoc analysis revealed that there was a statistically significant difference between the control condition ($M = 3.39$, $SD = 1.80$) and the general social norms appeal condition ($M = 4.06$, $SD = 1.74$), (*Mdiff* =.67, 95% CI [.21, 1.14], $p = .002$). There was also a statistically significant difference between the control condition and the ingroup norms appeal condition ($M = 3.87$, $SD = 1.75$),

(*Mdiff* =.48, 95% CI [.02, .93], p = .036). There was no statistically significant difference between the general social norms appeal condition and the ingroup norms appeal condition (*Mdiff* = .19, 95% CI [-.25, .64], p = .556). Both experimental conditions tried to reduce their water consumption in the bathroom throughout the course of the intervention.

Non-bathroom Water Conservation. As a test of a main effect of the normative interventions on these items, a MANOVA was then conducted, in which the three items (*efforts to conserve water: 1) in the kitchen; 2) in the laundry; and 3) outside of the residence*) were treated as dependent variables. There was no statistically significant difference between conditions on the combined dependent variables, $F(6, 980) = 0.82$, p = .554; Wilks' Λ = .990; partial η^2 = .005. Thus, there was no main effect of the normative interventions on efforts to conserve water outside of the bathroom. Univariate tests revealed that there was no difference across conditions in reported effort to conserve water in the kitchen M = 3.85, SD = 1.79, $F(2,492) = .961$, p = .383), laundry (M = 4.86, SD = 2.10, $F(2,492) = 1.491$, p = .226), or outside of the residence building (M = 3.84, SD = 1.94, $F(2,492) = 1.936$, p = .145).

As the manipulation specifically targeted water behaviour in the bathroom, and not overarching general water behaviours, it is reasonable that there was not a direct effect on behaviour. However, there may have been an indirect effect. That is, when participants increased their efforts to conserve water in the shower (*increased effort to save water in the bathroom*) as a direct effect of the normative interventions, this subsequently led to an increased effort to save water outside of the bathroom. This generalisation of climate resilient water behaviour in the bathroom to climate resilient water behaviour in other domains was investigated by examining the

indirect path from the normative interventions to water saving efforts (in the kitchen; laundry; and outside of the residence) *through* water saving effort in the bathroom. The examination of this indirect pathway is the most appropriate test, as it specifically tests the generalisation process, in which climate resilient water behaviour performed in the bathroom spreads to other domains (for similar procedure *see* Lauren et al., 2016).

Hayes (2013) MEDIATE macro for SPSS was used to conduct the analyses. Because the independent variable had three levels indicator coding was used to create two dummy variables. The control condition was treated as a reference group. The first dummy variable examined the effect of the general social norms appeal condition compared to the control (D1), and the second compared the effect of the ingroup norms appeal compared to the control (D2). Bootstrapped analyses were conducted using 5,000 resamples. Analysis on effort to undertake water-related behaviours in the kitchen revealed a significant indirect effect through water-related bathroom behaviours in both the general social norms appeal condition and the ingroup norms appeal condition; both normative primes led to an increase in reported effort to conserve water in the bathroom, which then led to increased efforts to conserve water in the kitchen. This effect extended across both the general and social identity normative prime in the laundry and outside of the accommodation (*see* Table 3).

Table 3 Point estimates and confidence intervals for indirect effect of the normative interventions on efforts to save water in non-targeted domains (kitchen; laundry; outside accommodation) via an increase in effort to save water in the bathroom

	General Social Norms Appeal (D1)		Ingroup Norms Appeal (D2)	
	b (SE)	95% CI	*b (SE)*	95% CI
Kitchen	.36 (.11)	[.15, .59]	.26 (.11)	[.06, .49]
Laundry	.29 (.10)	[.12, .51]	.21 (.09)	[.04, .41]
Outside of Accommodation	.39 (.12)	[.18, .64]	.28 (.11)	[.07, .51]

Note: All results reported are based on 5,000 bootstrapped samples

5.3.4 Group Identification

In *Study 3*, we found that group identification moderated the effect of the ingroup norms appeal on climate resilient water behavioural intentions. The current study aimed to extend this analysis by examining whether group identification moderated the effect of the normative interventions on behaviour. We would expect group identification to moderate the effect of the ingroup norms appeal, consistent with findings from *Study 3*. We would not expect group identification to moderate the effect of the general social norms appeal, as a social identity was not made salient. As the referent informational influence process was not activated, group identification should not moderate the effect of the intervention on behaviour.

A moderation analysis was conducted to examine whether the effect of the normative interventions on behaviour (reduction of time in the shower) was moderated by group identification. Hayes' (2013) PROCESS macro for SPSS

(Model 1) was used to conduct the analysis. As the independent variable had three levels indicator coding was used to create two dummy variables. The control condition was treated as a reference group. The first dummy variable examined the effect of the general social norms appeal condition compared to the control (D1), and the second compared the effect of the ingroup norms appeal compared to the control (D2). Bootstrapped analyses were conducted using 5,000 resamples. No significant interaction was observed between condition and group identification for the general social norms appeal, β = .06, *p* = .758, or the ingroup norms appeal, β = .15, *p* = .458. Group identification did not moderate the effect of the normative interventions on behaviour.

Although the moderation was non-significant, it was still possible to examine the pattern of moderation for different levels of group identification. Simple slopes analyses was examined to determine the effect of condition on climate resilient water behavioural intentions when group identification was high (+ 1 *SD),* equal to the mean (0 *SD),* and low (- 1 *SD*) for both normative conditions. The effect of the general social norms appeal on behaviour was non-significant at all three levels of group identification: high (β = .13, *p* = .659); equal to the mean (β = .19, *p* = .404); low (β = .24, *p* = .424). Simple slopes analysis was then examined for the ingroup norms appeal. The effect of the intervention on behaviour was significant at the high level of group identification (β = .81, *p* = .005), and at group identification equal to the mean (β = .67, *p* = .002). It was only marginally significant when group identification was low (β = .52, *p* = .096); *see* Figure 12.

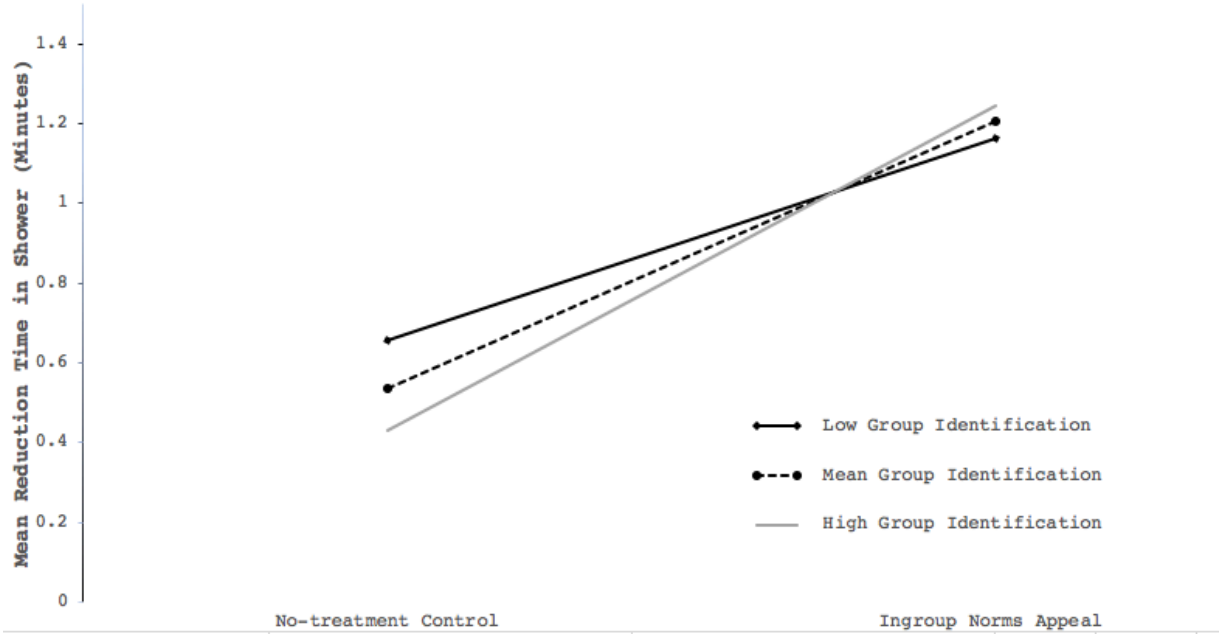

Figure 12 Mean reduction in shower time (minutes) as a function of experimental condition (ingroup norms appeal) and group identification

In *Study 3*, we found the effect of the ingroup norms appeal on behaviour was significant at high and average levels of group identification. These findings are supported by this current study. One point of differentiation is that in *Study 3*, the effect was non-significant at low levels of ingroup identification, yet in this current study, this effect was marginally significant. This may be attributable to the difference in the mean level of group identification across the two studies at low levels of group identification. In *Study 3*, at low levels of group identification, mean group identification score was $M = 4.29$, $SD = .57$. In the current study, for participants with low levels of group identification, mean group identification scores were significantly higher, $M = 5.26$, $SD = .86$, $t(18) = -7.359$, $p = < .001$. This difference between studies may also be attributable to when the measure was recorded. In *Study 3*, group identification was measured pre-intervention, and here,

they were measured post-intervention when participants had already been exposed to the ingroup norms appeal for two weeks. As it was not possible to gain a pre-intervention measure of group identification in this current study, the intervention itself may have influenced reported group identification scores in the ingroup norms appeal condition, leading to this observed difference.

5.4 Summary and Conclusion

In *Study 4*, we sought to understand whether the ingroup norms appeal would be effective when tested on actual behaviour in an experimental field trial at a university halls of residence. *Study 4* tested whether an ingroup norms appeal that targeted a specific behaviour - reducing time in the shower by one or two minutes - would be more effective than a standard general social norms appeal in eliciting climate resilient water behaviour. Our interventions were designed to increase perceptions of normative support for this behaviour at either a general societal level, or a group level.

As predicted by the social identity perspective (Tajfel & Turner, 1986; Turner et al., 1987), the general trend – the difference between the two normative conditions was marginally statistically significant - suggests an ingroup norms appeal was more effective than a standard social norms appeal in motivating water saving behaviour in the shower. When the normative information was tied to a contextually-salient group membership, individuals aligned their behaviour to this norm and reported conserving more water in the shower than participants in the general social norms appeal and control condition. As hypothesised, a standard social norms appeal did lead to an increase in climate resilient showering behaviour, but this influence was

optimised when a social identity was made salient and norms were framed in reference to a behaviourally-relevant referent group.

Importantly, it was demonstrated that although the intervention did not require a vast amount of resources to implement – only the waterproof stickers and time – the estimated savings of implementing an ingroup norms appeal is substantial. If the average savings achieved in the ingroup norms appeal condition (throughout the course of the two-week intervention) were to be extrapolated across the three accommodation buildings involved in this study, it would equate to a saving of 135,233 litres[3]. In comparison, if the savings achieved in the general social norms condition were to be extrapolated, it would equate to a savings of 83,135 litres[4] over the duration of the intervention, a difference of over 52,000 litres.

A limitation of *Study 4* was that the dependent variable was self-reported, as opposed to an objective measurement of water consumption, and therefore, may be prone to biases. For example, self-reported measures of past behaviour may be prone to social desirability biases (Ganster, Hennessey, & Luthans, 1983). This is especially important to acknowledge, as the pre- and post-intervention variable were reported at one time-point. Therefore, given the salience of the sticker in the bathroom and the survey questions, respondents may have been cognisant of the aims of the study and altered their responses accordingly. However, concerns regarding demand characteristics are in part mitigated by both experimental groups being exposed to the same demand. Although self-reporting may be prone to biases,

[3] Calculated as: (1.22 (mean reduction (minutes) in ingroup norms appeal condition) * 7 L (average shower flow rate per minute in university accommodation)) * 1.11 (average shower duration per day) * 1019 (residents in the three accommodation buildings included in the study) * 14 (days in the intervention)

[4] Calculated as: (0.75 (mean reduction (minutes) in general social norms appeal condition) * 7 L (average shower flow rate per minute in university accommodation)) * 1.11 (average shower duration per day) * 1019 (residents in the three accommodation buildings included in the study) * 14 (days in the intervention)

this would have likely been consistent across the treatment groups (Poortinga, Whitmarsh, & Suffolk, 2013). At times, it is pragmatic to rely on self-reported behaviour. For *Study 4*, although different companies developing shower smart metering technology were contacted (and met with) for over a one-year period prior to the study, it was not possible to access metering technology due to differing constraints. As such, the current study relied on self-reporting rather than an objective measure of behaviour.

An additional limitation relates the image presented in the experimental condition. An image of a rabbit was utilised in the ingroup norms appeal condition in Study 4 to make the social identity salient. A corresponding image was not employed in the general social norms condition, This approach is consistent with prior research (e.g. Seyranian et al. (2015) utilised an image in the social identity condition, but not in the general social norms condition), however, the use of the image in the ingroup norms appeal may have meant the ingroup norms appeal was more visually captivating and attractive. This may in turn have meant that the intervention appeal was more persuasive than the general social norms condition (*Elaboration Likelihood Model*; Petty & Cacioppo, 1986). The intervention text stickers were placed directly in the shower to ensure maximal attention during the course of the intervention, but it is possible including an image in the ingroup norms appeal led to greater engagement with the appeal itself. A further limitation is that respondents may have been aware of the purpose of the study and aligned their answers correspondently when answering the post-intervention survey. Future research should attempt to reduce this potential demand bias. Dependent variables could be measured less directly, for example, by asking respondents to detail their

morning routine and stating the amount of time they dedicate to each activity, rather than directly asking participants to estimate their shower time.

A further limitation to acknowledge is that the normative information provided in the intervention was not true; pilot data demonstrated that only a minority attempt to save water by reducing their time in the shower by one or two minutes (*see:* Table 1). There is precedent in the proenvironmental behaviour literature for this method (e.g. Masson & Fritsche, 2014; Toner et al., 2012), as behaviours that are targeted in a proenvironmental intervention are often those that are only undertaken by a minority. Elgaaied-Gambier and colleagues (2018) found that communicating a fictitious positive descriptive norm led to a change in proenvironmental behaviour and this was contingent on whether the information was perceived to be credible. If information is not credible, the intervention may not be influential or the intervention may backfire, as participants attempt to align their behaviour with this highlighted norm (Cialdini et al., 2006). In this intervention, this risk was in part mitigated by showering being a private behaviour. Each room in the study had an en-suite shower, so it would have been unlikely there was an already established, or well-known norm, for the ingroup. However, this is a consideration intervention designers must take into account. A further consideration is that while all of the studies in this thesis received full ethical approval prior to implementation, not debriefing participants post-intervention to advise that the normative information was inaccurate is ethically questionable. In future research, this additional step should be taken.

Confidence in our dependent variable is in part supported by recent research findings in the residential water domain; UK-based research has shown that self-reported shower time correlates well with actual shower time. The Energy Saving's Trust (2013) found that the average shower lasted for a duration of 7 minutes and 48

seconds (UK sample), which was close to the individual self-reported measure of average shower duration of 7 minutes and 30 seconds (as recorded by the online Water Energy Calculator (n = 137,625). In addition, in a recent experiment investigating the efficacy of a social identity-informed intervention, Mallett and Melchiori (2016), found that self-reported shower duration did not significantly differ from an objective measure of shower duration. As such, for pragmatic reasons, the current study relied on self-reports for this study, and recent research suggests these self-reports may correlate well with actual shower time.

Our findings have meaningful implications for the design of environmental interventions. An important, but often overlooked, consideration in crafting normative messages is the referent group. Normative messages typically involve communications about the behaviour of 'others', but typically the referent group is not clearly defined (e.g. Fielding et al., 2013; Goldstein et al., 2008; Nolan et al., 2008; Schultz et al., 2016). From a social identity perspective, norms are tied to specific groups, and a norm has its effect because that group is behaviourally-relevant. People are influenced by ingroup norms as they prescribe the context-specific attitudes and behaviours appropriate for group members (Terry & Hogg, 1996). On the basis of our findings it is recommended that campaigns that address local environmental issues, such as water scarcity, should aim to showcase proenvironmental norms (i.e. relating to climate resilient water behaviour) of the group as a defining element of the group identity. Activating the regional identity (such as a local city, neighbourhood or community) and communicating information about the behaviour and practices of ingroup members should strengthen perceived ingroup norms regarding climate resilient water behaviour, resulting in increased water-savings efforts amongst community members.

Study 4 also provided new insights into behavioural spillover in the residential water domain, supporting the initial evidence base around climate resilient water behaviour and positive behavioural spillover (Lauren et al., 2016; Mitchell & Chesnutt, 2013). An indirect effect was found, whereby the normative interventions not only encouraged climate resilient water behaviour in the bathroom, but also, indirectly, in the kitchen, laundry, and outside of the accommodation, that is, in domains not explicitly targeted in the intervention. We did not find evidence of a direct effect of the normative interventions on efforts to conserve water in these non-targeted domains. Rather, the results suggest an indirect effect, whereby the normative interventions not only encouraged climate resilient water behaviour in the bathroom, but also, indirectly, in the kitchen, laundry, and outside of the accommodation. This indirect effect may be attributable to a desire for behavioural consistency; as participants began reducing water consumption in the bathroom, they may have been motivated to behave consistently in other areas, in a bid to increase cognitive consistency (Festinger, 1962; Thøgersen, 2004). These findings should provide further encouragement for practitioners considering the utilisation of normative appeals in the residential water domain.

In our supplementary exploratory analysis, we did not find that group identification moderated the effect of the general social norms appeal on behaviour at high, average, or low levels of group identification. As group identity was not made salient in the general social norms condition, this was consistent with expectations. However, it was anticipated that in line with the results from *Study 3*, group identity would moderate the effect of the ingroup norms appeal on behaviour. Although the interaction between group identification and condition was non-significant, simple slopes analysis revealed that the effect of the intervention was

consistent with that observed in *Study 3*. At high and average levels of group identification, the moderation effect was statistically significant.

The present research demonstrates that not only is an ingroup norm appeal effective in motivating actual climate resilient water behaviour at high and average levels of group identification, but it is also more effective than a general social norms appeal. Our findings have implications for the future development of social norms interventions aiming to encourage climate resilient water behaviour. The process of psychologically belonging to a group means that the group becomes part of one's self concept and as a result, behaviours align with the norms advocated by the ingroup. In this study, it was demonstrated that this process can be harnessed to enhance the impact of a social norms intervention. It was also shown that these interventions can lead to a strengthening of climate resilient water behaviours beyond those which are directly targeted in an intervention, thereby potentially increasing the efficacy of the overall campaign. These findings provide critical insights for practitioners seeking to utilise an evidence-based social norms campaign to engage communities around climate resilient water behaviour.

6 Implementing Ingroup Norm Appeals in the Residential Domain: Bridging the Theory-Practice Gap

The final study of this thesis, Study 5, was conducted in collaboration with a regional water utility company and sought to examine the effect of an ingroup norms appeal on a direct measure of climate resilient water behaviour. Study 5 examined whether the approach could increase sign-up rates to a free residential water retrofitting campaign. In a randomised field trial (n = 2306), it was demonstrated that linking a social identity to climate resilient water behaviour and integrating information about supportive water conservation norms in one's residential group into a retrofitting campaign invitation letter increased sign-up rates. Results showed a significant increase in sign-up rates as a result of the modified letter. Individuals in the experimental group were 1.97 times more likely to sign-up to the retrofitting campaign than those in the control. Study 5 provides a further rigorous test of the ingroup norms appeal on a direct measure of behaviour and also serves to demonstrate how collaborative efforts between the research community and industry can lead to the development of evidence-based approaches to reduce water demand.

6.1 Introduction

In *Study 4*, we found our ingroup norms appeal successfully influenced a targeted behaviour - a reduction in time in the shower in a university halls of residence. Given the effectiveness of the appeal in a real-world setting, it is now important to extend the empirical evidence base and determine whether the approach is generalisable in encouraging climate resilient water behaviour a different context

and with a direct measure of actual behaviour. *Study 5* aimed to test this question in a large-scale field experiment conducted in collaboration with Anglian Water, the water utility company for the East of England. This model of collaborative research will become increasingly important as the UK water sector places a growing emphasis on building resilience.

6.1.1 The Case for Encouraging Climate Resilient Water Behaviour

As outlined in *Chapter 1*, despite perceptions of freshwater abundance, the UK is not exempt from water scarcity. By the 2050s, many catchments across the UK will need to manage water deficits; a challenge exacerbated by a decrease in freshwater availability as a result of climate change and a surge in demand for water - by 2030's, England and Wales is anticipated to grow by 9.6 million (Defra, 2011). The impacts of this are projected to be substantial. From an economic perspective, if a severe drought begins in the UK, the damage is valued at £1.3 billion per day (Water UK, 2016). Ambitious reductions in water demand in both commercial and domestic sectors are likely to be required (Committee on Climate Change, 2016).

To address this challenge, the Water Act (2014), introduced by the UK and Welsh Governments, was passed with the intent to reform the water industry and ensure long-term resilience, that is, to maintain long-term water supply and achieve water security in the face of disruption (Ofwat, 2015). The Act outlines that the long-term resilience of water systems should be secured through a range of measures including encouraging a reduction in water demand. Building resilience is now a priority area for the UK water sector and there is a strong focus on consumer engagement and behaviour change. It has been determined that the public should play an active role in building this resilience, both in terms of adaptation and mitigation (Ofwat, 2015). However, despite acknowledgement of the crucial role that

the public must play in building resilience, there is recognition that engagement with water users, particularly at a community-level, is often overlooked; engaging with communities to encourage climate resilient water behaviour is a relatively new area for the water sector (Spencer, 2017). To achieve the magnitude of reduction in demand that is required necessitates drawing on every tool in the box (Water UK, 2016), and importantly, establishing creative partnerships with stakeholders outside of the water sector's traditional operational domain. This includes working with the research community to design approaches to develop and test innovative solutions to ensure that water is used sustainably and to advance realistic applied solutions.

Across four studies it has now been established that an ingroup norms appeal could form an important component in this tool kit. It has been shown that the approach can optimise the influence of social norms interventions; the social influence strategy that has gained the most traction in the water sector thus far (e.g. Mitchell & Chesnutt, 2013). By integrating social identity insights into demand-side management strategies, it may be possible to encourage climate resilient water behaviour. However, as with any behaviour change intervention, it must first be rigorously tested in the field to determine whether it has the potential to impact actual water behaviour. The development of an extensive empirical evidence base is of particular importance within the water industry, as Ofwat, the economic regulator, will not agree to fund significant water conservation programmes unless the predicted savings can be supported by rigorous data from pilot studies (Howarth & Butler, 2004). As such, if climate resilient water behaviour interventions are to be funded in the future, it is crucial that an extensive empirical evidence base is established. An important aim of this thesis is to bridge the gap between research and practice. *Study 5* extended our understanding of the efficacy of an ingroup norms

appeal in a collaborative, applied study, conducted in collaboration with a water utility.

6.1.2 Applying a Behavioural Nudge

In *Study 5*, we harness the influence of ingroup norms to encourage an increase in sign-up rates to a water efficiency retrofit programme. Our ingroup norms appeal is integrated into an existing letter outlining the programme in a bid to increase the persuasiveness of the letter and therefore, increase sign-up rates. This could be defined as *nudge*; an approach that guides one to make a better decision (as judged by oneself), by drawing on cognitive insights (e.g. our tendency to align our behaviour to meaningful normative information) (Thaler & Sunstein, 2008). Nudges are voluntary, inexpensive to implement, are not underpinned by financial mechanisms, and there are no adverse consequences for an individual not aligning their behaviour with the desired outcome.

Providing social norms information is recognised as a nudge tool. The Behavioural Insights Team (BIT) in the UK; an organisation founded to apply nudge theory to enhance the efficiency of Government and public services, has utilised nudge theory, including providing social norms information, to successfully influence behaviour in different domains including taxation, health, and education (BIT, 2018). For example, as reported in the New Scientist (2016), in a bid to reduce the unnecessary use of antibiotics, BIT sent letters to 800 GP practices between 2014 to 2015 outlining that other practices were recommending the use of antibiotics in fewer cases (*descriptive social norm*). This message reduced antibiotic prescriptions by approximately 3 percent.

One study conducted by BIT is of particular relevance to this line of research. BIT aimed to understand whether social norms information - delivered through

direct letter mail-outs to residents - could be employed to encourage an increase in the number of UK citizens paying their tax on time. This question was examined in a randomised control trial (n = 140, 000) whereby letters were distributed to test three social norms treatments. The social norms information was integrated into the standard tax letter and stated that '9 out of 10 people pay their tax on time'. This information was framed in reference to either: 1) Britain; 2) the taxpayer's postcode; or 3) the taxpayer's home town. The efficacy of the letters was compared to a control (standard letter only). The results suggest the intervention was successful: in the control, 67.5 percent made payments on time; 72.5 percent in the national (Britain) condition; 79 percent in the postcode condition; and 83 percent in the home town condition (British Psychological Society, 2013). Notably, not only do these findings demonstrate the efficacy of providing social norms information to encourage behaviour change, they suggest the effect is strengthened the more proximal the norm becomes. If we interpret the experiment through a social identity lens, we see that the normative information in three treatment conditions were framed in reference to a social group (national; postcode; home town). The influence of the social norms information grew stronger the closer and more similar the referent group was to the individual. Thus, the more proximal the social identity - and ingroup normative information - became, the more effective the social norm nudge was, congruent with insights from the Social Identity Approach.

The social norms intervention had a substantial flow-on effect. It was estimated that the increased tax generated from a 15 percent increase in payments (difference between the control and the best-performing condition (home town) could equate to £160 million over a six-week period (British Psychological Society, 2013). This experiment therefore highlighted the benefits of a social norms

intervention delivered through direct letter mail-outs. It was inexpensive; easy to implement; did not require any changes to existing infrastructure or regulation; and led to a significant change in the targeted behaviour.

6.2 Current Research

Study 5 represents the first collaborative effort between researchers and the water utility in the East of England to encourage climate resilient water behaviour in the residential domain. It seeks to understand whether the ingroup norms appeal (or 'nudge') can be integrated into an existing water efficiency campaign to encourage greater levels of engagement. In line with referent informational influence (Hogg & Turner, 1987; Oakes et al., 1991; Turner, 1982), when an individual learns of supportive norms of a behaviourally-relevant social group, they should be more inclined to engage in behaviour congruent with this normative information.

Study 5 provides our final test of our ingroup norms appeal. In this experiment, we extend the results of *Study 4* and test the effect of the appeal on an objective measure of behaviour rather than self-reported or intended behaviour. This approach is examined in collaboration with the water utility company, Anglian Water. Anglian Water is responsible for over six million domestic and commercial customers in the East of England; one of the driest regions in the UK. Currently, residents in the region consume an average of 148 litres per person per day. Anglian Water's new demand-strategy aims to reduce consumption to 80 litres per person per day in the coming decades (Anglian Water, 2017a). This will require extensive engagement with consumers.

As part of their current consumer engagement strategy, Anglian Water offer a free residential retrofitting service (the 'Bits and Bobs' programme) where a plumber

will visit the customer's property and fit water efficiency devices, including low-flow showerheads, low-flow tap inserts, and a dual-flush converter. It is estimated that households save an average of 41 litres per day following the home visit (Anglian Water, 2017b). Households were recruited for the programme via a postal letter. However, sign-up rates were consistently low and Anglian Water were searching for a cost-effective avenue to increase uptake, hence, the selection of the programme for our collaborative research. In this study we tested whether adapting this letter to include an ingroup norms appeal would increase the likelihood of individuals signing up to the programme. In line with the previous four studies, we would expect the intervention to be more effective when an ingroup norms appeal is integrated into the existing campaign, as group members attempt to align their behaviour to the ingroup norm, in line with the referent informational influence process:

> **H1:** Integrating an ingroup norms appeal into the existing water efficiency campaign mail-out letter will lead to greater sign-up rates in comparison to the standard (existing) letter

6.2.1 Participants and Design

The study was conducted in Norfolk, UK in November 2016. The sample consisted of all metered households within 34 towns and villages in the southeast of the region. The total sample was 2306 households. Data was not available regarding household-level characteristics. Households were randomly assigned to receive either the standard control letter (n = 1158), or the intervention letter that integrated the ingroup norms appeal (n = 1148).

6.2.2 Procedure

Participants in the control group received a copy of the standard, existing letter used by the company (*see* Figure 13). It outlined why saving water was important in the region; the details of the retrofit programme; the benefits of signing-up (saving water, energy, and money); and details of how to register. The letter was designed to be a persuasive communication but was not specifically informed by behavioural science insights. In the intervention condition, the letter was identical, except for the integration of the ingroup norms appeal presented as a banner at the top of the letter (*see* Figure 14). The referent group for the manipulation was the residential county (Norfolk), which encompasses all 34 towns and villages included in the mail-out.

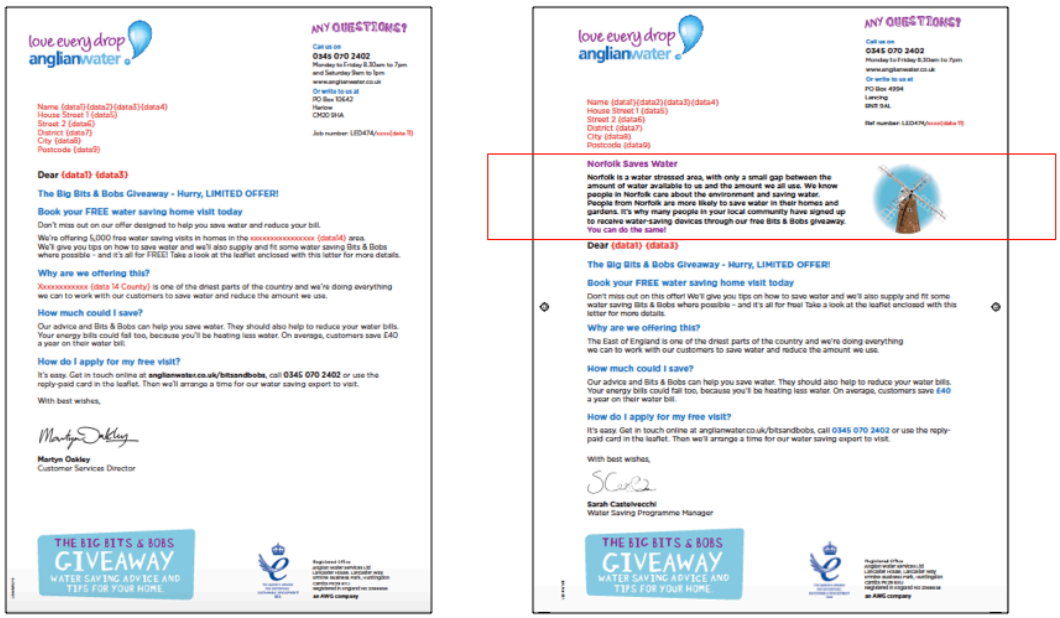

Figure 13 Anglian Water's standard letter (*left*) and experimental letter (*right*) integrating the ingroup norms appeal

The ingroup norms appeal first outlined the water challenges faced by region, and linked the social identity to resilient climate behaviour, 'We know people in

Norfolk care about the environment and saving water' (*injunctive norm*). The appeal then presented ingroup normative information, stating, 'People in Norfolk are more likely to save water in their homes and gardens' (*descriptive norm*). This information was informed by water consumption data from Anglian Water (2015a), demonstrating that regional average consumption was slightly less than the national average. The appeal then concluded by stating that the ingroup normative support for saving water was the reason why group members had already signed up for the water efficiency programme and appealed for recipients of the letter to the same. An illustration of a windmill, which is considered an icon of the local area, accompanied the message (*see* Figure 14). The researchers and water utility collaborated to develop the message; once the initial message was developed based on empirical insights, Anglian Water further refined the message to ensure the language and presentation was consistent with existing consumer engagement materials.

All residents were given the opportunity to contact the water utility to register for the programme either by telephone; returning an enclosed form; or online. The water utility company collated sign-ups across these platforms and provided us with the final data six weeks after the letters had been posted.

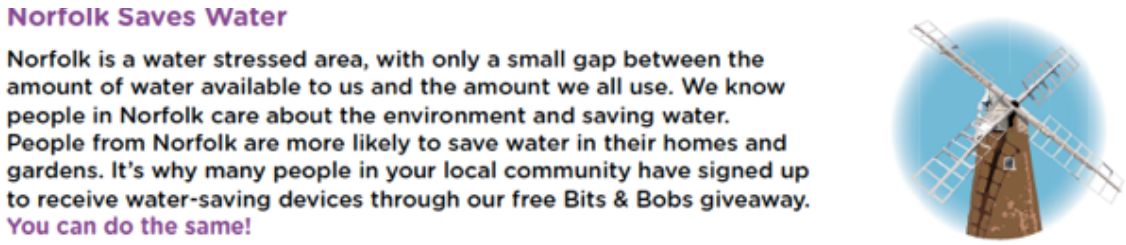

Figure 14 Ingroup norms appeal integrated into the direct letter mail-outs

6.2.3 Results and Discussion

A chi-squared analysis confirmed that the proportion of households who signed up to the programme was significantly higher in the social identity intervention condition, 4.97 percent, than in the control condition, 2.59 percent, $\chi^2(1, n = 2306) = 8.95$, $p = 0.02$ (*see* Figure 15). Examination of the odds ratio revealed that households who received the social identity letter were 1.97 times more likely to sign-up for the water-saving programme than those who received the standard letter.

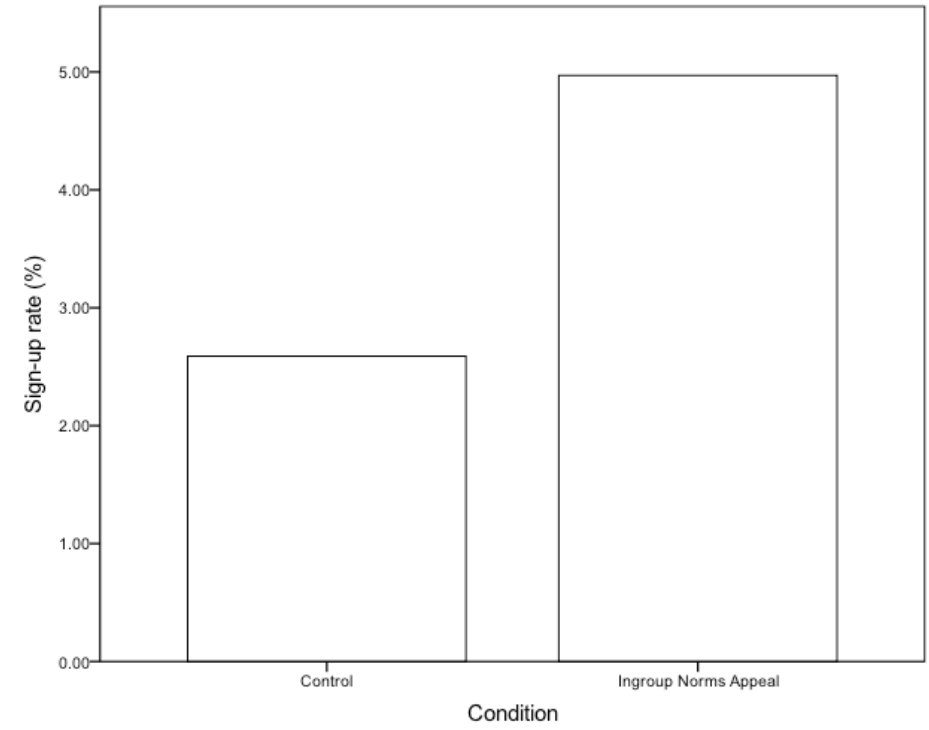

Figure 15 Final sign-up rates in the control condition (2.59 percent) and the ingroup norms appeal condition (4.97 percent) following the experiment field trial

These results provide further support that an ingroup norms appeal can encourage climate resilient water behaviour efforts. In this study, we collaborated with the region's water utility company to increase sign-ups for a retrofitting programme by incorporating an ingroup norms appeal into promotional materials. Sign-up rates were significantly higher amongst households who received our amended letter compared to those who received a standard letter containing no normative information. Our research provides an example of how researchers can partner with the water sector to engage consumers and increase resilience in a domain that is often overlooked (Water UK, 2016; Ofwat, 2017). Collaborations such as this will become increasingly important as environmental change and population growth place additional strain on regions already facing water stress.

A clear benefit of the ingroup norms appeal is that it has the potential to alter the way communities perceive and engage with water. Rather than fresh water being perceived as an unlimited resource solely managed by an external provider, the ingroup norms appeal reframes water as a resource that is valued by the group, and therefore conserved, within one's own community. An additional benefit of the approach is that it can be implemented in regions experiencing water scarcity without significant financial or infrastructural outlay. In this current study, it required only the inclusion of the ingroup norms appeal into the standard letter and therefore, did not require any additional financial resources to implement. However, the effects were substantial; the ingroup norms appeal almost doubled the sign-up rate to the programme. There may have also been potential for positive spillover to occur, thereby extending the effect of the intervention, although we were not able to examine this effect here.

Congruent with earlier findings, the results suggest that the ingroup norms appeal can be successfully applied to a social group that is not inherently defined by its proenvironmental tendencies. In this study, the effects observed in *Studies 1-4* were replicated with a regional identity (Norfolk), thereby demonstrating that the ingroup norms appeal is efficacious when applied in reference to different identities: university-level; city-level; and regional-level. These results increase confidence in the generalisability of our intervention approach.

In this study, overall sign-up rates were low, which speaks to the limitations of unsolicited letters as a communication method (Sinclair, O'Toole, Malawaraarachchi, & Leder, 2012). In 2001, a UK water efficiency campaign utilising local radio and newspaper advertising, bus stop posters, and direct mail-outs to 8000 households was evaluated and it was found that at most, only five percent of

households indicated they had noticed the campaign (Howarth & Butler, 2004). A second follow-on study was conducted to understand how many households had read our control and experimental letter, and therefore, gain a better understanding of the true effect size of the intervention. One hundred households (fifty households per condition; who did *not* sign-up for the programme) were randomly selected to ask whether they had noticed the letter, and if they had, why they decided not to sign-up for the programme. Due to consumer privacy regulation, the water utility conducted the research (via telephone) on our behalf and were only permitted to try calling each household once. Unfortunately, our final sample size was inadequate to conduct any meaningful analysis, but this is recommended as an area for future research, especially if we are to understand the true effect size of an intervention utilising direct mail-outs as the primary medium of communication.

Although only 4.97 percent of households were signing up for the programme in the experimental condition, if say, less than 10 percent of the total sample read the letter, the ingroup norms appeal may be more effective than our results suggest. Future research should also determine whether alternative mediums, such as targeted online campaigns, are more effective than direct mail-outs. This is important to investigate, as direct mail-outs may not be the most cost-effective approach to engage communities around resilient climate behaviour, if the findings from Howarth and Butler (2004) are reflective of the true rate of market penetration.

Despite the low sign-up rate, the water savings achieved as a result of this experiment were considerable. With an estimated average saving of 41 litres per day, per household, the increase in the number of households signed up to the programme achieved as a result of the ingroup norms appeal equates to a projected saving of

over 400,000 litres per year[5]. This is important to acknowledge, as although message-based normative interventions may yield relatively small effects, as we demonstrate here, they can be seamlessly and cost-effectively integrated into existing campaigns, as also demonstrated by the BIT's antibiotics letter to GP surgeries (New Scientist, 2016), or tax letter experiment (British Psychological Society, 2013). In line with previous social norms approaches, the ingroup norms appeal was easy and inexpensive to implement; led to a substantial behavioural change; and did not require any infrastructural or regulatory change. As such, the findings suggest interventions such as our ingroup norms appeal can offer a cost-effective and meaningful contribution to water demand management strategies. The ingroup norms appeal has now been integrated across Anglian Water's consumer engagement platform (both direct-mail-outs and online; *see* Figure 16 and 17).

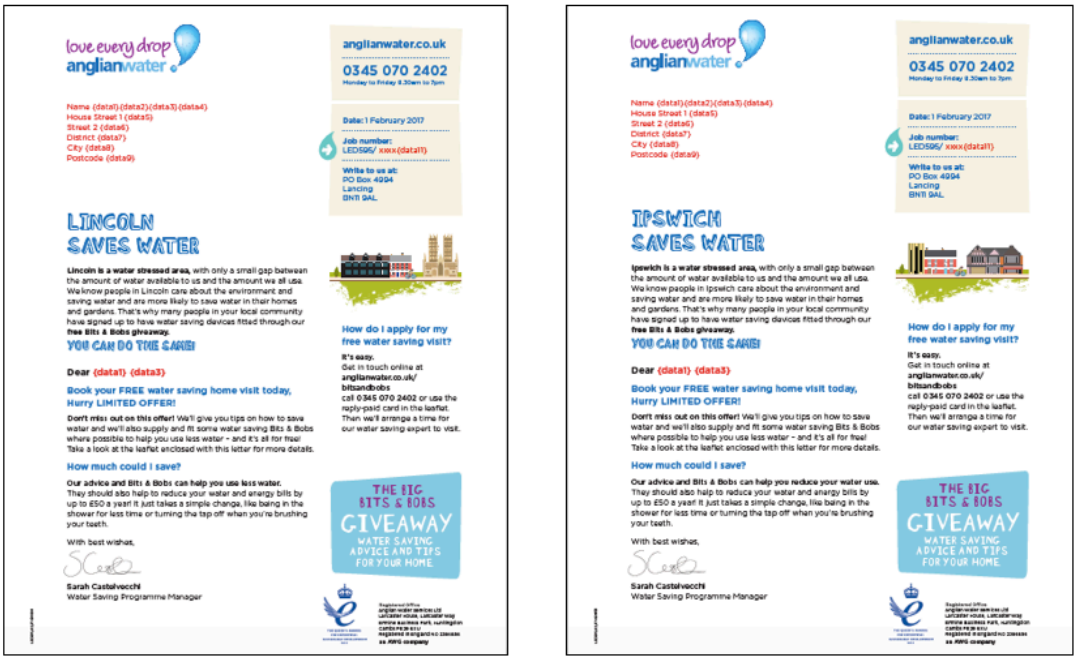

Figure 16 Anglian Water's letters to residents in Lincoln (left) and Ipswich (right) integrating the ingroup norms appeal

[5] Calculated as [27 (households) x 41 (litres of water saved per day)] x 365 (days per year)

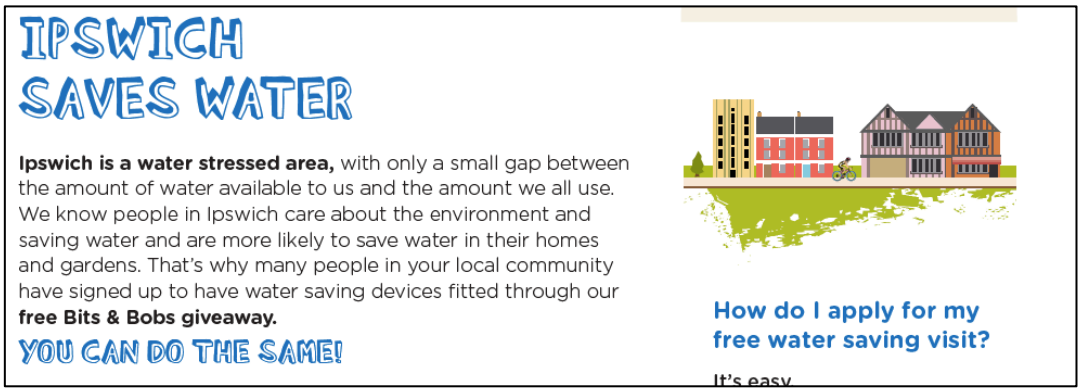

Figure 17 Anglian Water's ingroup norms appeal to residents in Ipswich

6.3 Summary and Conclusion

Our findings offer an important contribution to the emerging evidence base around social identity insights and behaviour change interventions in the residential water domain. We demonstrated that integrating an ingroup norms appeal into an existing campaign almost doubled sign-up rates and this was achieved at no additional cost to the water utility. A collaboration was developed with the water utility for over one-and-a-half years to design and implement this experiment and to ensure the research was not only rigorous, but also that it was relevant for industry and therefore, the results could feed back into current programmes. As a result of this collaboration, the ingroup norms approach has now been applied across the water utility's consumer engagement platform, as well as being utilised by an additional water utility in England, Essex & Suffolk Water. As such, this research serves as an example that successful collaborations between the research community and industry can lead to effective evidence-based outcomes. These collaborations will become increasingly important as the UK water sector strives to increase their resilience in order to ensure a sustainable supply of water into the future.

7 Discussion and Conclusion

Chapter 7 provides a summary of this thesis. Following a brief review of the theoretical background underpinning the research, the key empirical findings and theoretical advances are presented. Practical implications of the findings are then discussed, before examining potential limitations of the research and a proposal for a programme for future research.

7.1 Introduction

Water is life. As a species, we rely on water for our very survival. Water is a key indicator for the existence of life on other planets. Yet, we find ourselves in a time where the phenomenon of water scarcity is becoming increasingly commonplace. In 2018, Cape Town, South Africa, looked likely to become the first major city in the world to run out of water (Mulligan, 2018). Rather than water merely being an invisible resource, we have now reached a point where water end-users must be engaged. It is no longer enough to deliver water efficiently. In places where water flows freely from the tap, it is now vital that we also *use* water efficiently.

Research from the psychological sciences provides promising insights into how this may be achieved. For example, in *Chapter 2A*, we saw that initial applications of the social norms approach have delivered encouraging results. Experimental field trials in the US, UK, Australia, and Costa Rica have demonstrated that offering social norms information, that is, communicating how others behave or the behaviours others approve of, can lead to a reduction in residential water demand (e.g. Datta et al., 2015; Schultz et al., 2016). Promisingly, this approach is extremely cost-effective compared to alternative water demand

management strategies (Bernedo et al., 2014; Mitchell & Chesnutt, 2013). Although the implementation of the approach within the water sector is still in its infancy, thus far, it has been shown to offer a valuable contribution to the demand-management tool-kit. Given this, it has now become important to understand whether there are ways to enhance the approach. Insights from the Social Identity Approach may provide such an avenue.

The Social Identity Approach (Tajfel & Turner, 1986; Turner et al., 1987) demonstrates that the attitudinal and behavioural characteristics of psychologically-relevant referent groups can exert a powerful influence. Under a general social norms approach, *general others* serve as the vehicle for social influence. In comparison, under a social identity-informed approach, norms are tied to one's social group – one's *ingroup*. It may therefore be *ingroup others*, rather than *general others* that serve to guide behaviour when a social identity is salient.

When a social identity is salient, the process of *depersonalisation* - the cognitive process of self-categorisation to the group (Turner et al., 1987) - leads to an internalisation of ingroup norms; the group's norms becomes one's own (Hogg & Turner, 1987; Turner, 1985). As such, rather than a process of surface compliance to a general social norm, adherence to ingroup norms is intrinsically driven and underscored by internal cognitive change. Group members will act in alignment with ingroup norms and be highly attentive to new information outlining the group's normative stance. This process is known as *referent informational influence*. It is this process that can be harnessed to motivate behaviour change above and beyond that which can be realised with a general social norms appeal. Research examining the TPB in the proenvironmental behaviour suggests that ingroup norms may be a stronger determinant of behaviour than general social norms (e.g. Fielding,

McDonald, & Louis, 2008; Terry, Hogg, & White, 1999). Lab-based experiments have demonstrated that group members are likely to align their behaviour to newly acquired ingroup normative information when it is communicated in an intervention (e.g. Hogg & Turner, 1987; Terry, Hogg, & McKimmie, 2000).

Utilising these insights, it was predicted that messages providing a group context and source - highlighting a social identity while promoting ingroup norms favouring climate resilient water behaviour (an *ingroup norms appeal*) - would encourage corresponding behaviour change amongst group members. Across five studies, a comprehensive empirical examination of an ingroup norms appeal in the context of climate resilient water behaviour was provided. We integrated several lines of research and the findings have important theoretical and practical implications.

7.2 Summary of Findings

Study 1 provided initial evidence for the efficacy of the approach. The ingroup norms appeal was tested against an information-only control and a no-treatment control. The ingroup was defined as *UEA students* and data was collected at a public square at a university (UEA) in the East of England. The information-only appeal outlined why saving water was important and presented water saving advice. In the ingroup norms appeal condition, the same information was augmented with ingroup normative information suggesting that water saving behaviour was normative of the group. It was found that the ingroup norms appeal was marginally more effective in encouraging general climate resilient water behavioural intentions than an information-only campaign or a no-information control condition. While some evidence of the impact of providing information regarding to the need to conserve

water resources and water-saving actions was found, it was observed, in line with the referent informational influence process, that it is even more effective to frame this information in reference to a behaviourally-relevant ingroup.

Study 2 extended the initial empirical investigation and examined the mediating role of ingroup norms. It was hypothesised that perceptions of ingroup norms should mediate the effect of the ingroup norms appeal on general climate resilient water behavioural intentions. The sample differed from *Study 1*. The ingroup group was defined as *Norwich residents* and participants were sampled over a two day period in Norwich city centre. The ingroup norms appeal was adapted from *Study 1* and was tested against a no-treatment control. Congruent with the process of *internalisation*, when a social identity is salient, group members will view themselves in terms of the defining attributes of the group, and assimilate their behaviour so that it is consistent with their ingroup's norms (Hogg & Turner, 1987; Turner, 1985). Our findings provided further evidence of the efficacy of the ingroup norms appeal and confirmed the underlying mediational process.

The role of group identification was examined as a moderating variable in *Study 3*. Congruent with the Social Identity Approach, the strength of one's group identification should moderate the effect of an ingroup norms appeal on behavioural intentions (Kelly, 2011; Onorato & Turner, 2004). Individuals who highly identify with the group will be more likely to align their behaviour to the group norms compared to those possessing weaker levels of group identification (Abrams & Hogg, 1990). The ingroup norms appeal was tested on the same ingroup as *Study 1* (*UEA students)*. The appeal was adapted from *Study 2* and featured one refinement: the link between climate resilient water behaviour and ingroup identity was explicitly stated. The ingroup norms appeal was tested against a no-treatment

control. In *Study 3*, it was found that exposure to the ingroup norms appeal increased intentions to undertake climate resilient water behaviour and this effect was qualified by a significant interaction with group identification. The effect of condition was *only* significant for those possessing high or average levels of group identification. For participants with low levels of group identification, the effect of the intervention was non-significant.

Study 4 investigated whether the ingroup norms appeal would be more effective than a general social norms appeal in targeting a specific high-impact behaviour (reducing time in the shower by one to two minutes; self-reported). *Study 4* moved beyond behavioural intentions and examined the effect of the normative appeals in an experimental field trial at a university residence. Participants across three residences were allocated to one of three conditions: an ingroup norms appeal; general social norms appeal; or a no-treatment control. In the two normative conditions, a water-proof sticker was placed in each en-suite shower at the beginning of the intervention. Post-intervention surveys were disseminated two-weeks later. As hypothesised, and congruent with insights from the Social Identity Approach (Terry & Hogg, 1996; Terry, Hogg, & White, 1999), while the general social norms appeal was effective in encouraging a reduction in shower time, the observed trend suggested it was even more effective to frame the normative appeal in reference to a behaviourally relevant group.

The examination of the ingroup norms appeal then culminated in our final experiment; *Study 5*. In a large-scale randomised control trial implemented in collaboration with the East of England's water utility company with over 2300 households, it was found that the ingroup norms appeal could be integrated into an existing campaign letter to encourage an increase in sign-up rates to a retrofit

programme. In the ingroup norms appeal condition, households were 1.97 times more likely to register for the programme than those in the control condition. This experiment not only examined an objective measure of behaviour, but importantly, also demonstrated that collaboration between the research community and the water sector can lead to the development of novel, applied solutions to water challenges.

7.3 Theoretical Contributions

This body of work represents the first comprehensive examination of an ingroup norms appeal in the context of a proenvironmental behavioural intervention. The ingroup norms appeal, which aims to harness the power of the referent informational influence process, was developed and tested across five studies. Specifically, the ingroup norms appeal sought to make a relevant social identity salient (*UEA Student; Norwich resident; Norfolk resident*) and then tie climate resilient water behaviour to this identity by stressing that this behaviour is ingroup normative and defines and characterises the group identity. Across multiple participant populations, it was demonstrated that the ingroup norms appeal was successful in encouraging climate resilient water behavioural intentions and actual behaviour. The following section provides an overview of the key theoretical contributions.

Extension of Empirical Evidence Base. The findings extend the initial empirical evidence base on social identity solutions to encourage climate resilient water behaviour. Two previous studies provided some initial evidence that social identity-informed interventions could be utilised within the residential water domain. The first tested a social identity message to encourage a reduction in residential water demand in a high-water consuming affluent neighbourhood in California

(Seyranian, Sinatra, & Polikoff, 2015). The second assessed the effect of a social identity-informed communication campaign at a university halls of residence on showering and general water conservation behaviours (Mallett & Melchiori, 2016). This thesis extended this initial body of evidence in several important ways. In the social identity communication developed by Seyranian and colleagues (2015), normative information was provided in reference to the city government, rather than the group members per se. This thesis aimed to develop and test an ingroup norms appeal that specifically referenced and provided normative information about the target ingroup, in order to optimise the influence of the referent informational influence process. In Mallet and Melchiori's (2016) study, due to multiple treatments being applied throughout the intervention, it was not possible to ascertain which treatments exerted an effect, or to what extent they influenced behaviour. This thesis aimed to examine the ingroup norms appeal as a single treatment. Neither study examined the mechanisms underlying the effect on behaviour (mediating and moderating variables). Our empirical insights were strengthened as a consequence of employing experimental designs across the five studies, thus enabling causal inferences to be drawn.

Efficacy of the Ingroup Norms Appeal. This thesis tested the efficacy of an ingroup norms appeal informed by the referent informational influence process across five studies. In each experiment, the appeal was more effective in encouraging climate resilient water behaviour than alternative approaches (information-only condition and general social norms appeal) or a no-treatment control condition. This effect was replicated across five samples and three different social groups - *UEA students; Norwich residents*; and *Norfolk residents* – thus, increasing confidence in the generalisability of the approach.

More Effective Than Information-alone. The first study showed that the ingroup norms appeal was more effective than a no-treatment control and offering information-alone. Providing information to consumers is the most widely-utilised engagement strategy within the water sector (Howarth & Butler, 2004; Syme, Nancarrow, & Seligman, 2000). *Study 1* was the first test of a strict ingroup norms appeal in the context of climate resilient water behaviour. The results demonstrated that while information can lead to a positive change in behavioural intentions, an ingroup norms appeal is more effective.

General Social Norms Appeal vs. Ingroup Norms Appeal. While the power of normative messages to elicit proenvironmental behaviour has been established, most notably in the energy domain (e.g. Allcott, 2011), and recently in the water domain (e.g. Fielding et al., 2013; Schultz et al., 2016), this thesis demonstrated that only providing information about general others' behaviour was sub-optimal. This was the first strict test of a social identity-informed message (harnessing the referent informational influence process) against a general social norms message. In prior research (Seyranian et al., 2015), the general social norms information was delivered in conjunction with feedback on average residential water consumption, thus, it was not possible to attribute the behavioural effect to a single treatment, and the social identity message communicated the norms of the city government, rather than the ingroup per se. Our empirical findings demonstrated that normative messages will be even more influential when they are tied to salient and relevant group memberships and climate resilient water behaviour norms are communicated. Thus, by harnessing the power of the referent informational influence process, it is possible to enhance the efficacy of social norms messaging.

Mediating and Moderating Variables. This thesis also provided the first empirical examination of the variables mediating and moderating the effect of the ingroup norms appeal on behavioural intentions. It was found that in line with the referent informational influence process, perceptions of ingroup norms mediate the effect of the appeal on behaviour, and group identification moderates the effect; *Study 3* revealed the appeal is only successful for those who possess a high or moderate level of group identification. This examination enabled the first insights into *why* the approach was efficacious, and *for whom* the approach would be persuasive in the context of climate resilient water behaviour.

Targeted and Non-targeted Behaviours. Studies 1-3 provided a measure of behavioural intentions (general climate resilient water behaviour) and the two large-scale randomised experimental field trials targeted a specific high-impact behaviour (self-reported in *Study 4;* and an objective measure in *Study 5*). While previous studies testing normative messages to encourage climate resilient water behaviour in the field have focused on general water behaviour (i.e. try and reduce your overall water consumption) (Fielding et al., 2013; Schultz et al., 2016; Seyranian et al., 2015), *Study 4 and 5* tested whether an ingroup norms appeal could be utilised to target specific high-impact behaviours. Insight into whether specific behaviours can be targeted is crucial as it enables the targeting of those actions that matter most, and in turn, yield the highest savings. It was demonstrated that the ingroup norms appeal was successful in motivating behaviour change for two specific behaviours (both a habitual behaviour (a reduction in shower time) and an efficiency behaviour (encouraging households to sign-up for a residential water efficiency retrofit programme)).

Positive Behavioural Spillover. Promisingly, the findings from an exploratory supplementary analysis in *Study 4* suggest that the ingroup norms appeal may enable positive spillover, that is, the potential for a positive change in our targeted behaviour to lead to subsequent changes in other water saving behaviours (Nash et al., 2017; Truelove et al., 2014). An indirect effect was found, whereby the normative interventions not only encouraged climate resilient water behaviour in the bathroom, but also, indirectly, in the kitchen, laundry, and outside of the accommodation. These were not domains explicitly targeted in the intervention. This may be attributed to a desire for behavioural consistency; as participants began reducing water consumption in the shower, they may have been motivated to behave consistently in other areas in a bid to increase cognitive consistency (Festinger, 1962; Thøgersen, 2004). These results are promising and suggest that the results of the intervention may have extended beyond that which was directly targeted. This finding offers valuable insight into the overall effect of a climate resilient water behaviour intervention and contributes to the limited empirical evidence base around behavioural spillover in the water domain (Lauren et al., 2016; Mitchell & Chesnutt, 2013).

It extends the spillover literature in several ways. Firstly, while the majority of spillover literature is correlational in nature (Truelove et al., 2014), the experimental design employed in this research enables causal inferences to be drawn. Given an indirect effect was found, whereby an increased effort to conserve water in the bathroom led to an increased effort outside of the targeted domain - the effect of the intervention on non-targeted behaviour was mediated by a change in targeted behaviour - the results suggest a behaviour generalization mechanism is at play. While potential causal underlying mechanisms have been considered in the spillover

literature (e.g. Nash et al., 2017; Truelove et al., 2014), empirical evidence is limited. This finding therefore provides an important contribution to the field. It also suggests spillover scholars should consider indirect effects, as well as direct effects, when investigating the effect of proenvironmental behaviour interventions.

Additionally, empirical observations of inter-domain spillover (behaviours changing outside of the setting where the initial targeted behaviour is set) has been limited. For example, Littleford and colleagues (2014) found in a study investigating the potential for spillover behaviours between the home and office found that the setting in which a behaviour was undertaken was particularly influential and therefore, the potential for spillover to occur across settings was limited. Although actual behaviour was not measured in *Study 5*, the results suggest that there may be potential for inter-domain spillover in climate resilient water behaviours. This divergence from Littleford and colleague's findings may be a result of settings being relatively similar. For example, while energy infrastructure may be quite different between the office and one's home (e.g. lighting may not be controlled by an individual at work), water infrastructure (e.g. showers; taps) – and how individuals engage with this infrastructure - may not differ to such a great extent across domains. Accounting for behavioural spillover in future research is crucial if intervention designers are to understand the true net effect of a given intervention and attempt to optimise the potential for positive spillover (Gillingham et al., 2013; Nash et al., 2017).

7.4 Insights for Practitioners

The findings also offered important insights that are directly relevant for practitioners. Firstly, ingroup norms appeals should be considered as a valuable

addition to demand-management strategies. Recent evaluations of the UK water sector have acknowledged that more effort must be made to engage consumers and encourage a reduction in demand, especially given how important it has become that water end-users are engaged in a resilient water system and the recognition that they must play a crucial role in establishing this resilience (Ofwat, 2015; Roberts & Spencer, 2015). Social norms strategies have been demonstrated to have a meaningful effect in encouraging a reduction in water demand (e.g. Fielding et al., 2013; Schultz et al., 2016). Importantly, these approaches are appealing to water managers, as they do not require wide-sweeping legislative or infrastructural change.

Our research has shown that social identity insights can be utilised to optimise the effect of a social norms intervention. Importantly, the effects of the intervention were observed in sample groups that were not previously defined by their proenvironmental tendencies. Thus, through the application of the ingroup norms appeal, climate resilient water behaviour norms can come to characterise a group and encourage group members to act in line with this newly acquired ingroup normative information. However, our findings show that this effect is qualified by several considerations.

Group Identification. The findings from the group identification moderation analysis in *Study 3* and *4* demonstrate that although the ingroup norms appeal is influential for those possessing a high, or average level of group identification, it is unlikely to be effective for those possessing a low level of identification with the ingroup. It is therefore likely to be ineffective in contexts where a strong group identity has not been established or where individuals do not wish to be associated with the social group. This may occur, for example, in transient communities, or perhaps in neighbourhoods that residents try and disassociate themselves with.

Importantly, if individuals do not feel they are a member of a group, there is a risk the intervention may backfire. The ingroup norms appeal may serve to provide a contrastive social comparison (e.g. Mussweiler, Rüter, & Epstude, 2004). Inferences may be made about what outgroup members do, for example, if ingroup members conserve water, then outgroup members do not. In a bid to assimilate to the outgroup, these individuals may then behave in a way that contrasts to the appeal, thereby worsening their behaviour. To avoid this risk, there are two possible avenues practitioners can pursue.

First, practitioners could change the foci of the identification by selecting a social identity or group membership that is more meaningful to the targeted sample. For example, practitioners could incorporate a group membership measure - including all social identities identified as potentially meaningful to the overall sample - into a pre-test with a representative sample. Respondents could rate to what extent they identify with, or are proud to be a member of each specific group, and the group identity with the highest mean score could be selected (the group identification scale in *Study 4* could be utilised or adapted for use in this pre-test). Alternatively, if this is not feasible or it is not possible to select a meaningful identity, practitioners could instead utilise a general social norms appeal, specifying what the majority of 'others' do, without explicitly stating *who* these 'others' are.

Credibility. It is crucial information provided in an ingroup normative appeal is credible, as the intervention is unlikely to be effective if it is perceived to be untrue (Elgaaied-Gambier et al., 2018), or the intervention could backfire, as participants attempt to align their behaviour with the true norm (Cialdini et al., 2006). Providing a credible norm can be difficult, given that the behaviours that are targeted in a proenvironmental intervention are often those that are only undertaken by a

minority. If it is not possible to communicate a supportive descriptive ingroup norm, previous research examining social norms interventions in the proenvironmental domain suggest that in this context, shifting attention to the injunctive aspect of the norm could provide an avenue to remedy a negative descriptive norm (Cialdini et al., 2006). Alternatively, recent research suggests that communicating a *dynamic norm* may also offer a promising alternative (Sparkman & Walton, 2017). A dynamic norm communicates the number of people who are positively shifting their behaviour towards the desired proenvironmental outcome and highlights the increasing support for the behaviour, for example: '30 percent of people have begun to save water in the garden by not watering their lawn'. Providing information about how the ingroup norm is positively shifting may offer an avenue to encourage behaviour change even if it is not possible to provide supportive descriptive or injunctive ingroup normative information.

UK-context. Furthermore, this thesis provided the first test of an ingroup norms appeal in a UK context. This provides a deeper insight into whether social identity insights can be applied in an environment that differs significantly from the US context, both in terms of water use behaviour – for example, in the US, the highest proportion of water is used for landscaping in the residential domain (Inskeep & Attari, 2014); in the UK, it is showering (Energy Saving Trust, 2013) – and also in regards to perceptions around water. While there is a strong awareness of water scarcity in California (Day, 2015), this is less pronounced in the UK. In England, there exists a common misconception that there are abundant freshwater resources (Anglian Water, 2015a; Lowe et al., 2014).

Meaningful Behavioural Change. As demonstrated in our collaborative study with Anglian Water, implementation may require only the inclusion of

psychologically-informed text and an accompanying image into an existing campaign letter. Therefore, an ingroup norms appeal provides a cost-effective behaviour change mechanism. Similar to the social norms intervention successfully applied through direct letter mail-out in the BIT's tax experiment (British Psychological Society, 2013), the approach is voluntary; it is not underscored by a financial mechanism; and can easily be integrated into existing materials. Importantly, it can lead to meaningful behavioural change, thereby offering an extremely cost-effective means to encourage climate resilient water behaviour. For example, if we extrapolate our results in *Study 4* to examine the effect if the ingroup norms appeal were to be rolled-out to all rooms on the university campus, this would have equated to an average saving of over half-a-million litres of water (565,484.13)[6] over the course of the two-week intervention. Despite the small effect sizes, there is still potential for substantial reductions in water demand to be realised.

A Complementary Approach. A crucial consideration for practitioners to note is that behavioural interventions should not be viewed as a panacea to water demand management challenges. Instead, it should be perceived as a complementary approach, and one to be implemented alongside infrastructural and regulatory advancements. A recent study from Las Vegas, Nevada, demonstrates why this is so important (Brelsford & Abbott, 2017). From 1996-2007, the city experienced a decline in water demand of 55 percent. This was in part attributed to infrastructural change; new builds incorporated more water efficient infrastructure. Additional demand-management approaches should always be considered by water managers. For example, in some contexts, financial incentives also appear to be an effective

[6] Calculated as: (1.22 (mean reduction (minutes) in ingroup norms appeal condition) * 7 L (average shower flow rate per minute in university accommodation)) * 1.11 (average shower frequency per day) * 4261 (rooms at university campus) * 14 (days in the intervention)

means to encourage climate resilient water behaviour (Allon & Sofoulis, 2006; Gilbertson et al., 2011). It will also be crucial to address existing barriers, such as perceptions of inconvenience or impracticality, or the costs associated with implementing water efficiency devices (Dolnicar & Hurlimann, 2010).

Potential approaches should always be tested, especially if they are to be implemented in unison to ensure that they are indeed complementary and do not serve to undermine one another. For example, financial incentives may *crowd out* one's intrinsic motivation (Deci et al., 1999; Gneezy & Rustichini, 2000), whereby a behaviour that is undertaken because it is understood to be 'the right thing to do' is replaced with the expectation of an external reward. It may send the unintended signal that the behaviour would not normally be undertaken without an external reward and may in turn lead to inaction, as individuals do not want to risk being the only one to comply voluntarily if no one else is (*Sucker Effect;* Kerr, 1983).

Additional Social Influence Strategies. It is important also to note that there are additional social influence approaches that can potentially be harnessed and implemented in conjunction with an ingroup norms appeal (e.g. Abrahamse & Steg, 2013), for example, signing a public pledge. The effectiveness of such an approach relates to individuals' need for consistency; to not engage in a promised behaviour would promote uncomfortable feelings of cognitive dissonance and when commitments are made public there is additional, external pressure to behave consistently with the pledge (e.g. Baca-Motes, Brown, Gneezy, Keenan, & Nelson, 2013). Public pledges could be framed in reference to an ingroup or delivered in conjunction with an ingroup norms appeal. Social identity insights may also be utilised to refine, or optimise the effect, of alternative social influence approaches.

7.5 Collaboration

A key strength of this thesis is that it bridged the theoretical-practice gap. Theoretical assumptions were first examined in a controlled-setting with surveys, before moving to test hypotheses in the field. Consistent with Kahan and Carpenter's (2017) recent call to bridge the theory-practice gap, this process is crucial if behavioural science insights are to inform potential solutions to our most pressing environmental challenges. Collaborations were established with industry partners in two field experiments to ensure that our investigation would not only offer a theoretical contribution, but that it would be meaningful to practitioners and, therefore, be utilised outside of the research domain. Establishing this collaboration took time and persistence, but it was well worth the effort. Importantly, these collaborative partnerships were forged at the beginning of the research project, to ensure that the research could align with their existing projects, and as such, the results could be impact-orientated and integrated into the organisation's ongoing programmes.

University Impact (UEA). The results of our first experimental field study have also influenced the engagement approaches now employed by the university's sustainability team. For example, the ingroup norms approach informed a recent UEA energy campaign (*see* Figure 18). The message was printed on 5000 drink coasters and provided in every residential room on campus (4261 rooms) as well as being distributed as take-home items at UEA events throughout 2018. The approach was also incorporated into a December 2017 UEA-wide campaign to encourage energy saving over the holidays.

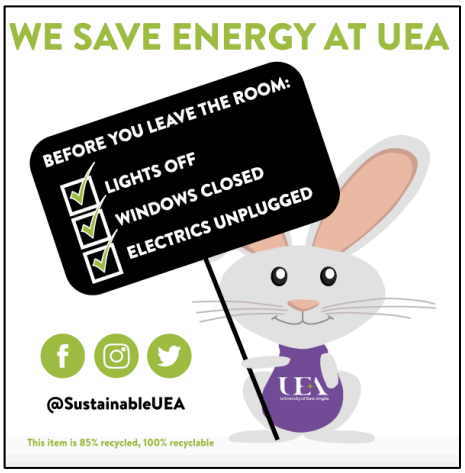

Figure 18 A 2018 Sustainable UEA campaign integrating the ingroup norms approach, adapted from *Study 4*

UK water sector. Our field trial with Anglian Water translated to an annual water saving of over 400,000 litres in the region and the approach has now been integrated across the water utility's consumer engagement platform (direct-letter mail outs and online). The ingroup norms appeal has been adapted for different areas in the East of England and each appeal is delivered in conjunction with a tailored image to enhance the ingroup norms appeal. In addition, the approach is currently being integrated by a second water utility in England: Essex & Suffolk Water. The ingroup norms appeal will be integrated into Essex & Suffolk Water's direct-letter mail-out kit that aims to encourage households to sign-up for a water retrofit programme. To enhance the potential for future impact, the results of the research have been presented at water industry conferences and in presentations directly to water utility managers and directors (*see* Appendix E for thesis-related water sector presentations and awards).

Collaborative Research. The results of *Study 5* also served as proof-of-concept to demonstrate the co-benefits of collaboration for the recently founded Anglian

Centre for Water Studies (2018) - a new partnership between Anglian Water and the University of East Anglia. 'Engaging Society' is a key theme of the newly established research centre. As such, this body of research was not only able to offer a theoretical contribution but also demonstrated that these new scientific insights could be utilised with effect within a non-academic context. These research partnerships will become even more important as climate change continues to alter water availability and demand for water continues to surge. We no longer have the luxury of confining our scientific investigations to the lab.

7.6 Limitations

There are several potential limitations to take into account. The first relates to the generalisability of the research. All studies were conducted in the East of England and although the ingroup norms appeal successfully influenced behaviour when tested on three different social groups, the empirical tests were all confined to one region. While our results are promising and suggest that the approach may be efficacious beyond the boundaries of the region, as with any proenvironmental behavioural intervention, it is important that the approach is tested prior to implementation if a wider application is to be considered.

Regional Variation. One potential limitation regarding the generalisability of the approach is that the region (East of England) may have been more amenable to proenvironmental behaviour change interventions. For example, in 2006, Norwich was voted Britain's greenest community, based on the city having the highest concentration of eco-friendly businesses in the country (Barkham, 2006). Given this proenvironmental predisposition, residents may not only be more responsive to a climate resilient water behaviour intervention, but when ingroup normative

information was presented, there may have be more of a tendency to perceive the normative information as being credible, and thus, the referent informational influence process and the subsequent effects on behaviour may have been strengthened.

Intention-Behaviour Gap. Further, a limitation that must be acknowledged is that across the five studies, three of these studies relied on behavioural intentions, one on self-reported behaviour, and only one study captured an objective measure of actual behaviour. It is well established that stated intentions may not translate into a change in behaviour, and subsequently, behavioural intentions may not always correlate highly with actual behaviour ('*intention-behaviour gap*'; Sheeran, 2002). In addition, self-reported measures of past behaviour (and hypothetical future behaviours) may be prone to biases, including social desirability biases (Ganster et al., 1983). Although the majority of studies examining proenvironmental behaviour change rely on measures of behavioural intentions and self-reported behaviour, it is nonetheless important to recognise the limitation that measures of behavioural intentions and self-reported behaviour may not accurately capture or reflect the true measure of behavioural change. It is therefore important to supplement these results with actual measures of objective behaviour (Steg & Vlek, 2009).

It may however, be pragmatic to rely on measures of behavioural intentions or self-reported behaviour. For example, for the university field study, the researcher followed-up leads and contacted different organisations for over one year to find a device that could provide an objective measure of the targeted behaviour in the university residences, while also meeting tight budgetary constraints. One device met the requirements and was tested in the accommodation with success, but the

technology was not ready to be rolled-out in time for the study. As such, *Study 4* relied on self-reported behaviour.

Demand Biases. In the first four studies, where behavioural intentions or self-reported behaviour was recorded as the outcome variable, there may have been the potential for demand effects to adversely affect validity. For example, participants in the experimental conditions may have guessed the overall purpose of the research and as such, respond correspondently. Future research should utilise methodological techniques to aim to reduce the potential for demand biases to occur. For example, the dependent variable could be couched in a series of other questions or tasks that require attention to be shifted from the intervention text (e.g. solving a word or simple math problem) or alternatively, rather than directly asking the dependent variable, it may be measured through an indirect measure. For example, showering time may be measured by asking respondents to detail their morning routine and the number of minutes on average they spend on each task (in the past fortnight). By doing so, risk of demand biases may be mitigated.

Non-message Interventions. Across the five studies, this thesis only examined the effects of a message-based intervention. However, there are additional ways social identity insights may be integrated into a climate resilient water behaviour intervention. For example, real-time feedback on water consumption in the shower (e.g. using a smart water shower meter) could be framed in reference to one's ingroup. Instead of presenting only personalised data, a comparison could be made to the mean, or to shower-water efficient group members, to enhance the influence of the approach. This may also be extended to smart water meters with an inhouse display, or online customer portals. This thesis focused on message-based interventions, as they are currently the primary medium through which climate

resilient water behaviour interventions are communicated. As such, insights from the research would be directly relevant to our collaborating partners. However, this does limit the generalisability of the results.

Effect Size. It is also important to recognise that the ingroup norms appeal intervention yielded small (d = .33, *Study 2*; η^2 = .018, *Study 4;* odds ratio = 1.97, *Study 5*) to medium (e.g. η^2 = .13, *Study 1;* d = .54, *Study 3*) effect sizes (Chen, Cohen, & Chen, 2010; Cohen, 1969). Thus, as a single-treatment intervention, if we were to translate these results to a population level, it may render the intervention less effective than alternative approaches, such as offering financial incentives to install water efficiency devices (Dolnicar, Hurlimann, & Grün, 2012). The intervention should be considered as a complementary approach in water demand management strategies, rather than an approach to be implemented in isolation. These small to medium effect sizes are consistent with research into nudge-based approaches (Lin, Osman, & Ashcroft, 2017; Thaler & Sunstein, 2008) and it is important to note that although effect sizes may not be large, the resulting impact can still be meaningful, as observed in *Study 4* and *5*.

'*Sample Size*. Selection of sample size was determined by a) precedents set by prior relevant research (examining ingroup norms-based interventions utilising experimental methods (multiple conditions); results collected in-person rather than online; and with university student samples) - Study 1; 2; 3); or b) maximising the sample as much as was feasibly possible (constraints determined by research partners) - Study 4; 5. For Study 1, 2, and 3, relevant prior research (with statistically significant differences observed between conditions) utilised a range of sample sizes (per condition) of between approximately 22 (Toner et al., 2012); to 50 (Rabinovich, Morton, Postmes, & Verplanken, 2012); to 100 (Masson & Fritsche, 2014) . There

was no discussion in these papers relating to sample size selection. Given the small to medium effect sizes realised in the interventions – consistent with prior research into social norms interventions in the residential water domain (e.g. Mitchell & Chesnutt, 2013; Schultz et al., 2016) – appropriate sample sizes should have been calculated pre-experiment (*a priori power analysis*). Using *Study 2* as an example – where a marginally statistically significant effect of the intervention on water conservation ingroup norms was observed - a post-hoc power analysis reveals that (with a small effect size, $d = .33$; $\alpha = .05$; statistical power = .80; two-tailed test (Faul, Erdfelder, Lang, & Buchner, 2007)); to observe an effect of the intervention with 80% power, the recommended sample size is 146 per condition, rather than the average of 62 per condition realised in the Study 2. Therefore, the study was underpowered. This increases the risk of type II error; failing to reject a null hypothesis that is in fact false (Freiman, Chalmers, Smith, & Kuebler, 1978). In order to avoid type II errors, and thereby increase the validity of research observations and conclusions, future research should always carry out an a priori power analysis for each experiment to determine an adequate sample size.

Longitudinal Effects. Another important limitation in our research is that our field experiments only lasted for a maximum duration of between two (*Study 4*) to six weeks (*Study 5*). It will therefore be important to examine the longitudinal effects of the ingroup norms appeal and understand whether changes to ingroup norms and, in turn, behaviour, endure. It is important to understand whether the influence of the intervention would cease if the behavioural cue was removed (e.g. removal of the sticker in the university residences), or if a natural cue (e.g. drought and associated media coverage) would lead to a strengthening of the intervention, or whether people would become desensitised to normative messages over time. It will be essential for

practitioners and members of the research community work together to consider how interventions can be tailored to achieve maximum benefit and whether behavioural intentions translate into actual changes in behaviour (McKenzie-Mohr, 2011).

7.7 Areas for Future Research

Unfortunately, when implementing behavioural interventions, there is no silver bullet. Contextual differences necessitate the development of tailored and evidence-driven interventions. For example, in some contexts, perceptions of vulnerability to drought may encourage greater responsiveness to intervention (Lam, 2006), while inaccurate perceptions of abundant freshwater may require different communication tactics (Lowe et al., 2014). The influence of social norms may also differ across cultural contexts, with some cultures being more susceptible to normative influences. For example, Abrams and colleagues (1998) measured the effects of both personal and normative factors in the employee turnover intentions in Britain and Japan. Results showed that the effect of normative influence on intentions was significantly stronger in Japan, which is considered to be a more collectivist (prioritising the group over the individual) country than Britain.

Behavioural Spillover. Future research should also investigate the potential for behavioural spillover and the mechanisms underlying the effect to ensure positive spillover is realised, and negative spillover minimised, where possible. Spillover behaviour was only examined in one study (*Study 4*) and evidence was found of an indirect effect. The effects of behavioural spillover would ideally be examined more in-depth in the field. Mitchell and Chesnutt's (2013) finding is promising: households receiving Watersmart's water savings report (including social norms information and socially comparative feedback) were subsequently more likely to

sign-up for a water efficiency retrofit programme. Future research may examine whether households exposed to an ingroup norms appeal are more likely to partake in future climate resilient water behaviours. The potential for positive behavioural spillover and the mechanisms underlying this process could also be examined qualitatively. For example, following an intervention where positive behavioural spillover is observed, participants could be interviewed to gain a more in-depth understanding of the underlying motivations to partake in climate resilient water behaviour beyond that which was targeted. This would enable a more nuanced understanding of behavioural spillover and the potential to maximise the effect in future behaviour change interventions.

Communication Medium. In the future, we should expect to see advancements in regard to the medium of communication and the ability to deliver targeted interventions as smart water metering technology becomes more pervasive. For example, in regards to the communication medium, previous research has shown that the market penetration rate of direct letter mail-outs is approximately 5 percent (Howarth & Butler, 2004). We are therefore, losing an estimated 95 percent of our selected sample population as a direct result of the selected communication medium. Future research may investigate the application of an ingroup norms appeal in an online campaign, and this may also enable an investigation into more tailored and personalised social groups, based on interests rather than residential location (e.g. community interest groups). Research should examine whether these tailored appeals are more efficacious, as group identification may be higher overall in these targeted appeals. There are, however, ethical concerns regarding targeted tailored persuasive messaging (e.g. the recent Cambridge Analytica scandal (BBC, 2018)). These

concerns must be addressed if proenvironmental messaging progresses in this direction.

Intervention Messages. Future research should also examine whether ingroup norms appeals can be delivered at the point of behaviour, thereby potentially enhancing their effect (Perkins, Linkenbach, Lewis, & Neighbors, 2010). For example, in *Study 4*, the normative interventions encouraging participants to reduce their time in the shower were delivered in the form of water-proof stickers and placed in the showers. In Richetin and colleagues' (2016) examination of a social norms message to encourage a reduction in water consumption while handwashing, messages were delivered on the hand soap bottle. This may also present an opportunity for researchers to establish new lines of collaboration. For example, organisations, such as Colgate (2017) and GlaxoSmithKline (2018), have developed water conservation campaigns based around their personal hygiene product lines (e.g. toothpaste), and organisations such as these may be open to collaboration with the research community.

Non-residential Domains and Indirect Water Behaviour. It is also important to understand whether these approaches are generalisable beyond the residential sector, and whether they can be applied to incentivise a reduction in water demand in other domains, such as the agricultural or industrial sector. Future research should also move beyond targeting direct water behaviours, and target indirect water consumption, which can have a substantial effect on global water supply. For example, the consumption of animal products contributes to more than one-quarter of humanity's total water footprint. In industrialised countries, encouraging a shift towards a vegetarian diet could reduce our food-related water footprint by up to 36

percent (Hoekstra, 2012) thus, encouraging a shift towards a plant-based diet can lead to substantial indirect water savings (Vanham, Hoekstra, & Bidoglio, 2013).

Intergroup Comparative Context. Future research should also consider the role of the intergroup comparative context. The social identity perspective suggests that social categories are understood in comparison to each other (Abrams & Hogg, 1988; Turner, Oakes, Haslam, & McGarty, 1994). Individuals strive to differentiate themselves from outgroups in their judgements and in their behaviour, and intergroup comparisons are made in a way that maximises intergroup differences (Oakes, Haslam, & Turner, 1994). Accordingly, when normative information is provided about individuals from a social outgroup, the behavioural tendency is to engage in the opposite pattern of actions (e.g. Doosje et al,. 1998; Rijswijk, Haslam, & Ellemers, 2006). This tendency has been documented in the domain of proenvironmental behaviour.

Rabinovitch and colleagues (2012) found that intentions to engage in proenvironmental behaviour were weakened when individuals compared their own national group (Britain) to an outgroup with a superior environmental record (Sweden), and strengthened when comparing to an outgroup perceived to be less environmentally conscious (USA) (see also Ferguson, Branscombe, & Reynolds, 2011). While our approach involves crafting normative messages that encourage people to see climate resilient water behaviour as defining of their group (i.e. a positive ingroup stereotype), another effective approach may be to provide information about negative outgroup stereotypes, eliciting a behavioural contrast effect. Future research should examine how providing information about the wasteful water behaviours of outgroup members may provide a complementary application of social identity principles.

Ingroup Messengers. Finally, future research could also examine whether an ingroup norms appeal may gain greater traction if delivered by an ingroup member. Schultz and Fielding (2014), for instance, found that the effect of an informational message about recycled drinking water on public perceptions of recycled water was enhanced when it was delivered by an ingroup member - in this case a scientist who shared a residential identity with participants (compared to a scientist whose identity was unknown). From a social identity perspective, ingroup sources are perceived to be more trusted and credible (Hornsey, Oppes, & Svensson, 2002; Kahan, Jenkins-Smith, & Braman, 2011). Findings are consistent with meta-analytic evidence (Abrahamse & Steg, 2013), demonstrating that social influence approaches to encourage resource conservation are most effective when delivered by members of the same social network, known as *the block leader approach*. This may offer an avenue to strengthen the effects of an ingroup norms appeal on behaviour.

7.8 Conclusion

Water scarcity is one of the challenges of our time. Addressing this challenge will require novel approaches. End-users must be engaged in this process and the ingroup norms appeal offers a promising avenue to motivate climate resilient water behaviour in the residential domain. This thesis provides the first comprehensive empirical examination of an ingroup norms appeal in the context of climate resilient water behaviour. It showed that providing normative information about the water saving actions of behaviourally-relevant others, motivated behavioural change. Across five studies, including two large-scale randomised experimental field trials, this thesis provided evidence of the efficacy of the approach against existing approaches (information-only campaigns and a general social norms appeal) and

offers novel insights into the underlying mechanisms. Effects were replicated across different contexts, with different target behaviours, and on measures of both intended and actual behaviour. This thesis also demonstrated that collaborative partnerships with non-research partners can lead to the development of novel solutions to our water challenges - the ingroup norms appeal developed in the course of this PhD is now being utilised within the UK water sector and at UEA. This model of research will become increasingly important as we strive to ensure water sustainability. It is essential that we bridge the science-practice gap by establishing partnerships through which applied, and evidence-driven solutions can be generated. There has never been a more important time to step out of the lab.

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Appendix A

Study 1 Survey

Experimental (Ingroup Norms Appeal) Treatment

UEA students save water

Although water may seem abundant, fresh water is a limited resource.

As UEA students, saving water and caring for the environment is part of who we are.

We're proud to be water savers and we do our bit to save water around the house – in the kitchen, in the bathroom, and while washing clothes.

Information-only (Treatment)

Save water

Although water may seem abundant, fresh water is a limited resource.

You can do your bit to save water around the house – in the kitchen, in the bathroom, and while washing clothes.

Questions (Presented to All Participants)

With this in mind, please rate how likely it is that you will perform the following actions over the next few weeks:

Wait until there is a full load of washing before beginning a wash cycle

Not at all likely						Very likely
1	2	3	4	5	6	7

Turn off the tap when brushing teeth

Not at all likely						Very likely
1	2	3	4	5	6	7

Turn off the tap if it is dripping

Not at all likely						Very likely
1	2	3	4	5	6	7

When washing hands, turn off the tap when lathering

Not at all likely						Very likely
1	2	3	4	5	6	7

Try to shorten time in the shower by one or two minutes to save water

Not at all likely						Very likely
1	2	3	4	5	6	7

When washing dishes, fill the sink or a container, rather than letting the tap run

Not at all likely						Very likely
1	2	3	4	5	6	7

Whenever possible, set the shower pressure to a low, or medium, rather than a high level

Not at all likely						Very likely
1	2	3	4	5	6	7

Reduce water consumption whenever possible

Not at all likely						Very likely
1	2	3	4	5	6	7

Socio-demographics

1) Age:

2) Gender *Female* *Male* *Prefer not to say*

3) Nationality:

4) Ethnicity:

5) Current degree*:* Undergraduate/Masters/PhD/Other

6) School (e.g. ENV):

7) Year of study:

8) What type of housing do you live in? (*Circle one option below*)

a) UEA student accommodation

b) Private accommodation (shared student house)

c) Private accommodation

d) Other

Is it currently raining? *Yes* *No* *Unsure*

Has it rained today? *Yes* *No* *Unsure*

Do you expect it to rain today? *Yes* *No* *Unsure*

Should we use your data for analysis? Sometimes people do not want us to because they were distracted or for some other reason. Please choose the appropriate answer below.

Yes, you should use my data *No, do not use my data*

Appendix B

Study 2 Survey

Please rate to what extent you agree or disagree with the following statements. Please circle your answer.

The East of England has abundant water resources

Strongly disagree						Strongly agree
1	2	3	4	5	6	7

The East of England can experience conditions of drought

Strongly disagree						Strongly agree
1	2	3	4	5	6	7

Experimental Text:

Did you know that in the East of England we live in an area of high water stress?
We receive the same average rainfall as Jerusalem, a city with a semi-arid climate, and as recently as 2012, our region experienced a drought!
Due to our low rainfall, our growing population, and a changing climate, water stress is expected to increase in the future.
As members of the Norwich community, we are trying our best to conserve water whenever we can.
We know how precious water and it's important to us that we save every drop. We're trying to cut the amount of water we use.
We're doing our bit to save water and we're already making a difference! For example, members of the Norwich community wait until there's a full load of clothes before beginning a wash cycle, turn off the tap if it hasn't been properly shut off, and turn off the tap when brushing teeth.
'I've saved 14 litres by spending two minutes less in the shower' – Chris, Norwich resident

Please rate to what extent you agree or disagree with the following statements.

Members of the Norwich community think that saving water is important

Strongly disagree						Strongly agree
1	2	3	4	5	6	7

As a member of the Norwich community, it is expected that I conserve water whenever possible

Strongly disagree						Strongly agree
1	2	3	4	5	6	7

Most members of the Norwich community try to conserve water

Strongly disagree						Strongly agree
1	2	3	4	5	6	7

Most members of the Norwich community do their bit to save water

Strongly disagree						Strongly agree
1	2	3	4	5	6	7

Please rate how likely it is that you will perform the following actions over the next few months:

Reduce water consumption whenever possible

Not at all likely						Very likely
1	2	3	4	5	6	7

Try to keep time in the shower to less than five minutes

Not at all likely						Very likely
1	2	3	4	5	6	7

Try to cook food with as little water as possible

Not at all likely						Very likely
1	2	3	4	5	6	7

When washing hands, turn off the tap when lathering

Not at all likely						Very likely
1	2	3	4	5	6	7

Try to soak pots and pans instead of letting the water run when scraping dishes clean

Not at all likely						Very likely
1	2	3	4	5	6	7

Try to shorten time in the shower by one minute

Not at all likely						Very likely
1	2	3	4	5	6	7

Socio-demographics

1) Do you live in Norwich? *Yes* *No*

2) How many years have you lived in Norwich?

3) Age

4) Gender

5) Nationality

6) Ethnicity

7) What type of housing do you live in?

I own my home *I rent my home* *Other*

Is it currently raining? *Yes* *No* *Unsure*

Has it rained today? *Yes* *No* *Unsure*

Do you expect it to rain today? *Yes* *No* *Unsure*

Should we use your data for analysis? Sometimes people do not want us to because they were distracted or for some other reason. Please choose the appropriate answer below.

Yes, you should use my data *No, do not use my data*

Thank you for taking part in this survey! Please return the completed survey to the researcher.

Appendix C

Study 3 Survey

Please rate to what extent you agree or disagree with the following statements (please circle).

To what extent do you feel like a UEA student?

Not at all						Extremely
1	2	3	4	5	6	7

To what extent do you feel strong ties with UEA students?

No ties at all						Extremely strong ties
1	2	3	4	5	6	7

To what extent do you feel pleased to be a UEA student?

Not pleased at all						Extremely pleased
1	2	3	4	5	6	7

How similar do you think you are to the average UEA student?

Not at all similar						Extremely similar
1	2	3	4	5	6	7

How important to you is being a UEA student?

Not at all important						Extremely important
1	2	3	4	5	6	7

How much are your views about UEA students shared by other UEA students?

Not shared by any						Shared by all
1	2	3	4	5	6	7

When you hear a person who is not a UEA student criticize UEA students, to what extent do you feel personally critized?

Not criticised at all						Extremely criticised
1	2	3	4	5	6	7

UEA students save water

At UEA we know that fresh water is a limited resource, and it's important to us to save every drop.

As UEA students, we're trying our best to save water wherever we can.

We're proud to be water savers and we do our bit to save water - we wait until we have a full load before washing our clothes; we turn off the tap when we brush our teeth; and we turn off taps if we see them dripping.

Saving water and caring for the environment is part of who we are.

Please rate how likely it is that you will perform the following actions over the next few months:

Wait until there is a full load of washing before beginning a wash cycle

Not at all likely						Very likely
1	2	3	4	5	6	7

Turn off the tap when brushing teeth

Not at all likely						Very likely
1	2	3	4	5	6	7

Turn off the tap if it is dripping

Not at all likely						Very likely
1	2	3	4	5	6	7

When washing hands, turn off the tap when lathering

Not at all likely						Very likely
1	2	3	4	5	6	7

Try to shorten time in the shower by one or two minutes to save water

Not at all likely						Very likely
1	2	3	4	5	6	7

When washing dishes, fill the sink or a container, rather than letting the tap run

Not at all likely						Very likely
1	2	3	4	5	6	7

Whenever possible, set the shower pressure to a low, or medium, rather than a high level

Not at all likely						Very likely
1	2	3	4	5	6	7

Reduce water consumption whenever possible

Not at all likely						Very likely
1	2	3	4	5	6	7

Socio-demographics

1) Age:

2) Gender *Female* *Male* *Prefer not to say*

3) Nationality:

4) Ethnicity:

5) Current degree*:* Undergraduate/Masters/PhD/Other

6) School (e.g. ENV):

7) Year of study:

8) What type of housing do you live in? (*Circle one option below*)

UEA student accommodation/ Private accommodation (shared student house)/ Private accommodation/Other

Is it currently raining? *Yes* *No* *Unsure*

Has it rained today? *Yes* *No* *Unsure*

Do you expect it to rain today? *Yes* *No* *Unsure*

Appendix D

Study 4 Survey

Hi, we hope you enjoy the **Skittles to say thanks for completing this quick two-sided survey!** The data will be used to inform a PhD student's research. **Please be sure to complete it this week, leave the survey where you found it, and it will be collected by the cleaning team** ☺

1) Bedroom Flat (*please circle*): A B C D E F G H J K L M

2) How many showers do you usually have? showers per day

3) In the last two weeks, my average shower lasted for minutes (if unsure, please estimate).

4) Not including the last two weeks, I usually shower for an average of minutes (if unsure, please estimate).

5) Thinking about the last two weeks, to what extent did you try and reduce your water consumption:

	Not at all						**Every time**
a) In the bathroom?	1	2	3	4	5	6	7
b) In the kitchen?	1	2	3	4	5	6	7
c) When doing laundry?	1	2	3	4	5	6	7
d) Outside of your accommodation?	1	2	3	4	5	6	7

8) Please rate to what extent you agree or disagree with the following statements:

	Strongly disagree						**Strongly agree**
a) I am proud to be a UEA student	1	2	3	4	5	6	7
b) Being a UEA student is important to me	1	2	3	4	5	6	7
c) I am glad to be a UEA student	1	2	3	4	5	6	7

9) Did you notice a new sign or sticker in your bathroom over the last week?

Yes No Unsure

10) If yes, what did it say?

Finally, please tell us your:

11) Age: **12) Gender:** **13) Nationality:**

14) Accommodation Block: *Britten* *Paston* *Colman*

15) Any additional comments?

Appendix E

Presentations to Water Industry (Thesis Specific)

- Lede, E (2017, March). *Utilising the Social Identity Approach to save water: Insights from the field.* Presented at Twenty65, Manchester
- Lede, E (2016, October). *Encouraging water conservation behaviour without financial incentives.* Presented at Anglian Water (Social Media and Marketing Team), Huntingdon
- Lede, E (2016, March). *Motivating water conservation behaviour without financial incentives: A field study*. The International Water Association Young Water Professionals Annual Conference, Norwich
    - Awarded: Best Conference Presentation
- Lede, E (2016, March). *Behaviour change and water efficiency (Panel discussion)*. Presented at Waterwise Annual Water Efficiency Conference, London
- Lede, E (2015). *Incentivising water conservation in residential domain*. Presented at Anglian Water (Team Managers), Huntingdon
- Insights contributed to: Danino, V (2018, May). *How to turn off the tap: Engaging society to reduce consumption.* Presented at Institute of Water One Day Science Conference, York

Awards and Grants (Thesis Research-specific: Engagement and Impact)

- UEA Engagement Award: Student Award for Outstanding Contribution to Public and Community Engagement, June, 2017
- German Federal Ministry of Education and Research's Green Talent Award (International Forum for High Potentials in Sustainable Development), October, 2017
- (ESRC) UEA Impact Accelerator Fund (to support research costs), Awarded April, 2017